

The University of Toronto
Chemical Library

Presented
to
The University of Toronto Library
by
William Lash Miller, B.A., Ph.D., C.B.E.
Professor Emeritus of Physical Chemistry
for
A Departmental Library to be under
the control of the Professor of
Chemistry according to the conditions
set out in a letter from the Librarian
of the University dated March 21.st
1938.



Digitized by the Internet Archive
in 2009 with funding from
University of Toronto

~~Chem & Phys~~
C

13572

PROCEEDINGS

OF

THE CHEMICAL SOCIETY.



Vol. XXVIII. Nos. 395—403.
JANUARY—DECEMBER, 1912.

360359
24. 1. 39.

LONDON:
GURNEY & JACKSON, 33, PATERNOSTER ROW.
1913.

QD

1

C63

V.28-30

cop.2

RICHARD CLAY AND SONS, LIMITED
BRUNSWICK ST., STAMFORD ST., S.E., AND
BUNGAY, SUFFOLK.

LIST OF GRANTS MADE FROM THE RESEARCH FUND
DURING THE YEAR 1912.

- £15 to F. W. Atack: action of metallic salts in their lower states of oxidation, and of other reducing agents, on typical dyestuffs and coloured substances.
- £5 to S. D. Adshead: preparation of *o*-carboxyphenylsuccinic acids,
- £5 to G. Barger and F. H. Carr: constitution of aconitine.
- £15 to T. V. Barker: studies in co-ordination, isomorphism, and valency.
- £5 to E. de B. Barnett: studies in the indene and fluorene series.
- £7 to G. Blackstock: condensation of butylene bromide with ethyl sodiomalonate.
- £5 to O. L. Brady: constitution of aconitine.
- £10 to J. C. Cain: santalin, and the chemistry of diphenyl derivatives.
- £8 to F. D. Chattaway: polymerism amongst the hydrazides and anilides (continued).
- £5 to R. W. L. Clarke: constitution of picrotoxinin.
- £5 to J. B. Cohen: bromination of toluene.
- £5 to C. R. Crymble: absorption spectra of the organo-metallic derivatives.
- £5 to J. C. Duff: preparation of substituted indigos.
- £10 to A. E. Dunstan: relation between viscosity and chemical constitution (continued).
- £8 to R. G. Fargher: condensation of ethyl sodiobenzoylacetate with 1:3-dibromobutane.
- £5 to J. Ferns: preparation and properties of sulphonic esters (continued).
- £7 to J. B. Firth: sorption of simple and mixed gases by charcoal.
- £10 to F. C. Garrett: ignition of mixtures of the paraffin hydrocarbons and air under varying conditions.
- £5 to N. Hall: derivatives of some α -ketonic acids.
- £5 to R. T. Hardman: electromotive forces in alcohol (continued).

- £12 to W. N. Haworth : synthesis of cantharene and camphenic acid.
- £5 to C. Hollins : synthesis of norpinic acids.
- £8 to E. Hope : condensation products of nitromeconine with cotarnine.
- £10 to E. Hope : condensation of certain sodium derivatives with unsaturated esters.
- £8 to A. Hopwood : synthesis of naphthyltyrosine and of polypeptides (continued).
- £5 to J. Kenner : reactions of derivatives of 2:2'-ditolyl.
- £5 to J. Kenner : investigation of the reactions of diphenyl-2:3:2':3'-tetracarboxylic acid.
- £10 to F. R. Lankshear : studies of epicamphor and its derivatives : electrolytic reduction of various diketones and aldehydes (continued).
- £5 to F. R. Lankshear : investigation of absorption spectra.
- £10 to J. W. McBain : chemical nature and physical properties of dental amalgams.
- £6 to G. Martin : relation of boron compounds to silicon compounds.
- £5 to F. A. Mason : oxidation of the methosulphates.
- £8 to P. May : some problems of tautomerism.
- £8 to R. W. Merriman : azeotropic mixtures of the lower alcohols with water.
- £5 to J. E. Myers : experiments on the effect of centrifugal force on various chemical equilibria.
- £5 to M. Nierenstein : investigation of hemlock tannic acid and of Knoppen tannic acid.
- £10 to W. R. Pratt : preparation of saturated and unsaturated ketones from isopropylidihydroresorcin.
- £10 to R. Robinson : synthesis of isoquinoline alkaloids (continued).
- £5 to R. Robinson : stereochemistry of the triphenylmethane group.
- £10 to H. Rogerson : synthesis of β -furancarboxylic acid, and the preparation of the β -substituted compounds of pyrrole and thiophen.
- £5 to D. Segaller : velocity coefficients of some iodo-compounds with sodium phenoxide in alcoholic solution at various temperatures (continued).
- £10 to Clarence Smith : (1) pyrogenic decomposition of organic alcohol and animal substances ; (2) investigation of liquid racemates ; (3) keto-enol tautomerism of α -hydrogenated carboxylic acids.
- £5 to S. Smith : the bromoxylene obtained by the action of phosphorus pentabromide on dimethyldihydroresorcin (continued).

- £6 to V. Steele: investigation into the terpene derived from carvone.
- £5 to T. R. Stopford: preparation of butyrolactone and 1:4-dibromobutane.
- £12 to F. B. Thole: relation between viscosity and chemical constitution.
- £8 to E. R. Thomas: influence of the constitution of tertiary bases on the rate of formation of quaternary ammonium salts.
- £5 to A. Wallace: preparation of anhydrous allyl alcohol.
- £10 to C. R. Young: derivatives of 1-methoxy- and *d*-dimethoxy succinic acids.

Total amount granted during 1912 = £361. 0. 0.

LIST OF FELLOWS ELECTED DURING 1912

Name.	Proposed.	Elected.
Allcock, Thomas.....	April 18th, 1912.....	June 20th.
Arkell, Daniell, B.Sc.	March 7th, 1912	May 2nd.
Amies, Edwin John, B.Sc.	June 20th, 1912	December 5th.
Backer, Hilmar Johannes	December 7th, 1911	February 15th.
Bailey, Clement William, M.Sc.	January 18th, 1912...	" "
Bailey, William Llewelyn.....	June 20th, 1912	December 5th.
Baker, James Henry Young	November 7th, 1912	" "
Barnett, Raymond Theodore Fred, B.Sc.	April 18th, 1912	June 20th.
Barrow, Fred, M.Sc., Ph.D.	December 21st, 1911	February 15th.
Bartow, Arthur Leslie	February 15th, 1912	May 2nd.
Bearder, Ernest Arthur, M.Sc.	December 7th, 1911	February 15th.
Bews, Charles James Vinall, B.Sc.	April 18th, 1912	June 20th.
Birks, Cyril Douglas	May 2nd, 1912.....	" "
Blackstock, Gibbs, B.A.	December 7th, 1911	February 15th.
Bones, Arthur Anderson	March 21st, 1912 ...	May 2nd.
Bowack, Douglas Anderson	November 7th, 1912	December 5th.
Bowater, William Henry	May 2nd, 1912.....	June 20th.
Bridge, James Ewart, B.Sc.	January 18th, 1912...	February 15th.
Brindle, Harry	April 18th, 1912	June 20th.
Brownlie, David, B.Sc.	December 21st, 1911	February 15th.
Brunjes, Thomas Alfred.....	" " "	" "
Bunker, Sidney Waterfield, B.Sc.	" " "	" "
Bryant, Ernest Gower	February 15th, 1912	May 2nd.
Buckle, Edmund Arthur	June 20th, 1912	December 5th.
Bury, Charles Rugeley, B.A. ...	February 15th, 1912	May 2nd.
Campbell, Alfred Varlow	May 2nd, 1912.....	June 20th.
Campbell, Arthur Fred, M.Sc.	" 16th, 1912..	" "
Chakraborty, Jatindranath, B.A.	April 18th, 1912	May 2nd.
Challinor, Richard Westman	November 7th, 1912	December 5th.
Chatterji, Bamacharan, M.A.	May 2nd, 1912.	June 20th.
Cheshire, Frank Lothian	April 18th, 1912.....	" "
Clark, Leslie Melville.....	May 16th, 1912	" "
Clarke, William Thomas, B.Sc.	January 18th, 1912...	February 15th.
Colelough, Tom Peach, M.Sc.	December 21st, 1911	" "
Coombs, Frank Andrew.....	November 7th, 1912	December 5th.
Cooper, Evelyn Ashley, B.Sc.	March 7th, 1912	May 2nd.
Crowther, Raymond Edwin	" 21st, 1912.....	" "
Curtis, Frederic Fernandez	December 7th, 1911	February 15th.
Dallas, William	March 21st, 1912.....	May 2nd.
Das, Bhupati Nath, M.A., B.Sc.	May 16th, 1912	June 20th.
Davys, Gerard Irvine, B.A., M.D., B.Ch.	" " " " " "	" "
De, Surendranath	January 18th, 1912	February 15th.
Dick, Thomas Sharp	November 16th, 1911	" "
Dieffenthaler, George Cruden	May 2nd, 1912.....	June 20th.

Name.	Proposed.	Elected.
Dixon, Walter Henry.....	November 7th, 1912	December 5th.
Dodds, Herbert Henry, M.Sc.	" 16th, 1911	" February 15th.
Dodson, Harold Forster.....	" 21st, 1912	December 5th.
Douglas, James Crawford	February 1st, 1912...	May 2nd.
Douglas, Robert Percy	December 21st, 1911	February 15th.
Duncan, John	May 16th, 1912	June 20th.
Dutta, Jatindra Mohan, M.A.....	June 6th, 1912.....	December 5th.
Dyson, James Harry		
Eastick, Frederick Charles, B.A.....	March 7th, 1912	May 2nd.
Ellis, Ridsdale, B.Sc.....	June 20th, 1912	December 5th.
Ellis, Rowland Holliday	December 7th, 1911	February 15th.
Ellis, George Davidson, B.Sc.	November 7th, 1912	December 5th.
Evans, Elliott Alfred.....	February 1st, 1912...	May 2nd.
Farlie, John Burke, jun	March 7th, 1912	" "
Fergusson, Donald MacEachern	May 16th, 1912	June 20th.
Fleet, Wilfred James	January 18th, 1912...	February 15th.
Foster, Alfred George Ernest	April 18th, 1912.....	June 20th.
Frankland, Edward Percy, B.A., Ph.D., M.Sc.	February 1st, 1912...	May 2nd.
Gadd, Sydney Charles	June 6th, 1912.....	December 5th.
Gajjar, Madanlal Jekisandas, M.A.....	April 18th, 1912	June 20th.
Gallooly, Michael Francis, B.A.	" " "	" " "
Garbutt, Cornelius Durham	December 21st, 1911	February 15th.
Gaul, Ernest George, M.Sc.	November 16th, 1911	" "
Ghosh, Jyotish Chandra	December 21st, 1911	" "
Gibbins, Richard Ernest	" " "	" " "
Glegg, Robert, B.Sc.	April 18th, 1912.....	June 20th.
Gray, Harold Heath, B.Sc.	November 7th, 1912	December 5th.
Gritzmacher, Frederick Lyle	" 21st, 1912	" "
Haines, Thomas Sidney.....	December 7th, 1911	February 15th.
Hale, Arthur James, B.Sc.	June 20th, 1912	December 5th.
Harding, Leonard	May 2nd, 1912.....	June 20th.
Hartley, Harold, M.Sc.....	" 16th, 1912.....	" "
Hatherly, Henry Medley	" " "	" " "
Hawkins, Walter Elmslie, B.Sc.....	February 1st, 1912...	May 2nd.
Haydon, Archie	June 20th, 1912	December 5th.
Heilbron, Isidor Morris, Ph.D.	January 18th, 1912...	February 15th.
Henius, Max, Ph.D.	May 16th, 1912	June 20th.
Heron, Harold.....	" 2nd, 1912	" "
Hill, James Grainger	February 15th, 1912	May 2nd.
Holden, Edmund Haworth, M.Sc.	April 18th, 1912.....	June 20th.
Hope, Edward, M.Sc.	June 20th, 1912	December 5th.
Howells, Oliver Richard, B.Sc.	March 7th, 1912.....	May 2nd
Hughes, John Owen, B.Sc.	February 15th, 1912	" "
Jamas, Ardesir Naserwanji Peston, M.A., B.Sc.	November 7th, 1912	December 5th.
James, Charles.....	January 18th, 1912...	February 15th.
James, Edward Lewis.....	May 16th, 1912	June 20th.
James, Edwin Oliver	April 18th, 1912	" "
Jewell, William	May 16th, 1912	" "
Jobling, Edgar, B.Sc.	November 7th, 1912	December 5th.

Name.	Proposed.	Elected.
Jones, Edgar Dingle	February 15th, 1912	May 2nd.
Jones, Richard Arnold Seymour, M.Sc....	" " "	" "
Keenan, Thomas John	May 2nd, 1912.....	June 20th.
Knox, Archibald.....	March 21st, 1912.....	May 2nd.
Komatsu, Shigeru	June 6th, 1912.....	December 5th.
Kuntzen, Harold Eric	April 18th, 1912	June 20th.
Lacey, Edwin Charles, B.Sc.	March 21st, 1912 ...	May 2nd.
Lampitt, Leslie Herbert, M.Sc.	" " "	" "
Langton, Harold McKee, B.Sc.	April 18th, 1912.....	June 20th.
Lankshear, Frederick Russell, B.A., M.Sc.	November 7th, 1912	December 5th.
Lenfestey, Harold John de Quetteville ..	February 1st, 1912 ...	May 2nd.
Levy, Stanley Isaac, B.A., B.Sc.....	November 7th, 1912	December 5th.
Lomax, Ernest Lawson, M.Sc.....	" "	" "
Lucas, William Thornton, B.A.	February 15th, 1912	May 2nd.
Macdonald, James Leslie Auld, B.Sc.	April 18th, 1912	June 20th.
McMillan, William.....	December 7th, 1911	February 15th.
McMyn, James William.....	January 18th, 1912	" "
Masani, Nadirshaw Adarji, M.A., B.Sc....	April 18th, 1912	June 20th.
Maxwell, Francis	June 20th, 1912	December 5th.
Meadon, Percival Edward, B.A.	May 2nd, 1912.....	June 20th.
Meister, Frederick James	" 16th, 1912	" "
Menon, Ambat Kesava, B.A.	February 1st, 1912 ...	May 2nd.
Menzies, Robert Charles	May 16th, 1912	June 20th.
Middleton, Herbert, M.Sc.	November 16th, 1911	February 15th.
Milbourne, Robert John	March 21st, 1912.....	May 2nd.
Modi, Pestanji Manekji, B.A.	January 18th, 1912	February 15th.
Morgan, Sidney	May 16th, 1912	June 20th.
Morrell, George Francis, Ph.D., B.Sc. ..	November 7th, 1912	December 5th.
Mumford, Ernest Moore, B.Sc.	" "	" "
Myers, Ernest Meyer	December 7th, 1911	February 15th.
Natrajan, Tanjore S.	November 21st, 1912	December 5th.
Naunton, William Johnson Smith, B.A., B.Sc.	December 7th, 1911	February 15th.
Neilson, Richard Gillies	January 18th, 1912	" "
Newman, Leslie Frank, B.A.	November 7th, 1912	December 5th.
Nichols, William Moore	" " "	" "
Nierenstein, Maximilian, Ph.D.	" " "	" "
Nowak, Carl Alfred, B.Sc.	" 21st, 1912	" "
Ogilvie, James Pettigrew	December 7th, 1911	February 15th.
O'Mara, James, B.A.	March 7th, 1912	May 2nd.
Orange, Lionel, B.Sc.	November 7th, 1912	December 5th.
Painter, George Macaulay, B.Sc.....	February 1st, 1912 ...	May 2nd.
Paniker, Ramni. M.A., M.Sc.	June 6th, 1912	December 5th.
Parkes, John Wilfrid	January 18th, 1912	February 15th.
Patterson, John William	November 7th, 1912	December 5th.
Pearson, George Ernest	May 16th, 1912	June 20th.
Pope, Rupert William, B.Sc.	December 21st, 1911	February 15th.
Potter, Charles Etty, B.Sc.	November 7th, 1912	December 5th.
Potter, Howard Vincent ...	December 21st, 1911	February 15th.

Name.	Proposed.	Elected.
Raitt, William	December 7th, 1911	February 15th.
Rakshit, Jitendra Nath.....	November 7th, 1912	December 5th.
Rayner, Edgar Alexander, B.Sc.	January 18th, 1912...	February 15th.
Reiners, Martin, L.R.C.P., L.R.C.S.	November 7th, 1912	December 5th.
Rennie, John	March 7th, 1912	May 2nd.
Rideal, Eric Keightley, B.A.	May 2nd, 1912.....	June 20th.
Roberts, Alfred Reginald	December 21st, 1911	February 15th.
Roberts, Walter Morrell, M.Sc.	" 7th, 1911	" "
Roper, Herbert Carr	June 20th, 1912	December 5th.
Sasson, Albert.....	November 7th, 1912	December 5th.
Scarborough, Harold Archibald, B.Sc. ...	" " "	" "
Scott, Walter	" " "	" "
Seal, Kunjo Behary	" " "	" "
Shaw, William Daveridge Hamilton, B.Sc.	May 16th, 1912	June 20th,
Shute, Henry Alfred, B.Sc.	February 1st, 1912 ...	May 2nd.
Singh, Bawa Kartar, B.A.	" 15th, 1912	" "
Sinear, Anakul Chandra, M.A.....	May 16th, 1912	June 20th.
Sladden, Cyril Edgar, B.A.	November 7th, 1912	December 5th.
Smart, Bertram James, B.Sc.	December 7th, 1911	February 15th.
Smith, Henry Edgar, M.Sc.	January 18th, 1912 ...	" "
Smith, Richard	December 21st, 1911	" "
Smith, Thomas Alfred, B.Sc.	November 7th, 1912	December 5th.
Smith, William Charles.....	" " "	" "
Steele, Victor	" " "	" "
Stephen, Alfred Ernest	" " "	" "
Strivens, Percy Rudolph	January 18th, 1912...	February 15th.
Thévenaz, William, D. és Sc.	May 16th, 1912	June 20th.
Thomas, William Leonard.....	" " "	" "
Thompson, Arthur	March 7th, 1912	May 2nd.
Thomson, John Scott.....	" 21st, 1912.....	" "
Till, William Compton, M.Sc.....	November 7th, 1912	December 5th.
Tsao, Hui Chun, B.Sc.	June 6th, 1912.....	" "
Ure, Paul Jenner.....	November 7th, 1912	" "
Waldron, Cecil Hamersley	December 7th, 1911	February 15th.
Walker, George	March 21st, 1912.....	May 2nd.
Wallace, Arthur, B.A., B.Sc.	February 1st, 1912 ...	" "
Waters, Percy Wharton.....	May 2nd, 1912.....	June 20th.
Whittick, Frederick George	April 18th, 1912.....	May 2nd.
Wilkins, Charles Reginald, B.Sc.	March 21st, 1912.....	" "
Williams, George Mason	April 18th, 1912.....	June 20th.
Wilson, Forsyth James, D.Sc., Ph.D. ...	January 18th, 1912...	February 15th.
Withers, John Charles, Ph.D.	December 7th, 1911	" "
Wood, John Kerfoot, D.Sc.	" 21st, 1911	" "

LIST OF HONORARY AND FOREIGN MEMBERS ELECTED DURING 1912.

Prof. Phillippe A. Guye	February 15th, 1912	March 7th.
Dr. Thomas Burr Osborne	" " "	" "
Prof. Paul Walden	" " "	" "
Prof. Dr. Richard Willstätter	" " "	" "

LIST OF FELLOWS DECEASED DURING 1912.

Name.	Elected.	Died.
*Attwood, George	February 18th, 1872 ...	February 9th, 1912.
Beanes, Alfred Edward	December 4th, 1902 ...	March 8th, 1912.
Black, Andrew Heggie	April 17th, 1879	April 22nd, 1912.
Bosanquet, Robert Holford Mac-dowall	February 2nd, 1865.....	August 7th, 1912.
Cameron, John Macdonald	June 17th, 1875	September 3rd, 1912.
Coupe, Miles.....	May 4th, 1905.....	November 13th, 1912.
* ¹ Divers, Edward.....	February 2nd, 1860.....	April 8th, 1912.
Ekins, Arthur Edward	December 20th, 1883 ..	March 12th, 1912.
Elkington, Algernon John.....	May 4th, 1911.....	February 5th, 1912.
Ferrier, John Oliver	February 19th, 1902 ...	June 17th, 1912.
Fraser, Angus	March 21st, 1867	April 2nd, 1912.
Griffiths, Thomas	April 17th, 1879	February 26th, 1912.
Hill, Alexander	March 16th, 1882	April, 24th, 1912.
Howell, Reginald	February 19th, 1880 ...	August 3rd, 1912.
Johnson, Otis Coe	March 4th, 1897	June 6th, 1912.
*Jones, Humphrey Owen	December 6th, 1900 ...	August 15th, 1912.
Kemp, David Skinner.....	April 4th, 1867	October 27th, 1912.
*Laycock, William Frederick	April 17th, 1890.....	September 25th, 1912.
Lichtenstein, Theodore David	February 21st, 1878 ...	October 23rd, 1912.
Low, Charles William	December 18th, 1884	August 9th, 1911.
McArthur, John.....	December 1st, 1887.....	December 19th, 1912.
Masters, William.....	December 4th, 1873 ...	September 29th, 1912.
*Mosenthal, Henry de	April 17th, 1890.....	December 18th, 1912.
Newlands, Benjamin Edward Reina	February 18th, 1864	August 7th, 1912.
* ² Pattinson, John.....	December 3rd, 1863 ...	March 28th, 1912.
Rao, B. Venkata.....	December 7th, 1911 ...	1912.
*Richardson, Arthur	June 18th, 1883	June 1st, 1912.
Salt, Henry	April 16th, 1863	November 4th, 1912.
Seward, Henry	January 20th, 1870	April 12th, 1912.
Starling, William Robert Rigg.....	December 6th, 1906 ...	September 25th, 1912.
Strangman, James Pinn	February 3rd, 1887.. ...	April 23rd, 1912.
* ³ Wade, John	February 6th, 1890.....	August 15th 1912.
*Wootton, William Ord.....	December 3rd, 1908 ...	October 17th, 1912.

LIST OF HONORARY AND FOREIGN MEMBERS DECEASED DURING 1912.

Boisbaudran, Lecoq de	February 2nd, 1888.....	May 28th, 1912.
Mallet, John William	March 2nd, 1911	November 9th, 1912.

* Contributed to the Transactions.

¹ Ordinary Member of Council, 1873-4 ; Vice-President, 1900-03.

² Vice-President, 1891-4.

³ Ordinary Member of Council, 1905-09.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY
DURING 1912.

	Page in Pro- ceedings.	Page in Trans- actions.
<i>January 18th.</i>		
1. The photophosphorescence of inorganic solid solutions. By A. Lionel Landau	2	—
2. The preparation of conductivity water. By Ferdinand Bernard Thole	3	207
3. The boiling points of mercury, cadmium, zinc, potassium, and sodium. By Charles Thomas Heycock and Francis Edward Everard Lamplough	3	—
4. The formation and reactions of imino-compounds. Part XVII. The alkylation of imino-compounds. By Jocelyn Field Thorpe	4	249
5. 1:2-Diketohydrindene. By William Henry Perkin, jun., Walter Morrell Roberts, and Robert Robinson	4	232
6. <i>iso</i> Narcotine. By Ernest Griffiths Jones, William Henry Perkin, jun., and Robert Robinson	4	257
7. Esterification constants of some substituted acetic and benzoic acids. By John Joseph Sudborough and Margaret Kathleen Turner	5	237
8. Aromatic antimony compounds. Part III. Primary aryl derivatives. By Percy May	5	1033
9. The aryl ethers of glycide, glycerol, and glycerol- α -mono- chlorohydrin. By Ernest Robert Marle	5	305
10. The action of ammonia on 6-chloro-2-phenyl 1:3-benz- oxazine-4-one. By Ernest Chislett Hughes and Arthur Walsh Titherley	6	219
11. The thio-analogues of coumarin and its derivatives. By Arthur Clayton and William Godden	6	210
12. Experiments on the synthesis of brazilin and hematoxylin and their derivatives. (Preliminary note.) By William Henry Perkin, jun., and Robert Robinson	7	—
13. The influence of solvents on the rotation of optically active compounds. Part XVII. The relationship between the chemical constitution and the influence of a solvent. By Thomas Stewart Patterson and Elizabeth Findlay Stevenson	8	241
<i>February 1st.</i>		
14. The constituents of commercial chrysarobin. By Frank Tutin and Hubert William Bentley Clewer	13	290
15. The existence of molecular compounds in solution. Part I. By Harold Langton and Albert Ernest Dunstan	14	418

	Page in Pro- ceedings.	Page in Trans- actions.
16. Researches on bleaching powder. Part II. The action of dilute acids on bleaching powder. By Robert Llewellyn Taylor and Clifford Bostock	14	444
17. The quantitative estimation of hydroxy-, amino-, and imino-derivatives of organic compounds by means of the Grignard reagent, and the nature of the changes taking place in solution. By Harold Hibbert	15	328
18. An exact investigation of the three component system: sodium oxide, acetic anhydride, water. By Alfred Charles Dunningham	16	431
19. β -Gnoscopine. (Preliminary note.) By Edward Hope and Robert Robinson	16	—
20. Anhydrohydrastininemeconine. (Preliminary note.) By Edward Hope and Robert Robinson	17	—
21. The preparation and properties of sulphonic esters. By John Ferns and Arthur Lapworth	18	273
22. Menthyl nitrilotriacetate. By Percy Faraday Frankland and Hugh Henry O'Sullivan	19	287
23. The viscosity of aqueous solutions of sodium palmitate and the influence of electrolytes on the same. By Frederick Denny Farrow	19	347
24. Aromatic amino-derivatives containing antimony. (Preliminary note.) By Gilbert T. Morgan and Frances M. G. Mickelthwait	19	—

February 15th.

25. Perhalides of diphenyliodinium iodide. By Martin Onslow Forster and Johannes Heinrich Schaeppi ...	37	382
26. The constitution and synthesis of damascenine, the alkaloid of <i>Nigella damascene</i> . By Arthur James Ewins ..	38	544
27. The action of ozone on cellulose. By Mary Cunningham and Charles Dorée	38	497
28. Hydroxymethylphosphinic acid and some homologues. By Harold James Page	38	423
29. Chemical examination of scammony root and of scammony. By Frederick Belding Power and Harold Rogerson	39	398
30. Experiments on the Walden inversion. Part VIII. α -Amino- α -phenylpropionic acids. By Alex. McKenzie and George William Clough	40	390
31. Preparation of the nitrites of the primary, secondary, and tertiary amines. Part I. By Pañchānan Neogi	41	—
32. Nitrites of the mercurialkyl- and mercurialkylaryl-ammonium series. By Prafulla Chandra Rāy, Jitendra Nath Rakshit, and Rasik Lal Datta	41	616
33. Nitrites of the alkylammonium series. Part IV. <i>isobutyl</i> , <i>diethyl</i> , <i>dipropyl</i> , and <i>tripropyl</i> -ammonium nitrites. By Prafulla Chandra Rāy and Jitendra Nath Rakshit	41	612

	Page in Pro- ceedings.	Page in Trans- actions.
34. The hydrolysis and saponification of esters of saturated and unsaturated acids. By Thomas Williams and John Joseph Sudborough ...	41	412
35. Investigations on the dependence of rotatory power on chemical constitution. (Preliminary note.) By Robert Howson Pickard and Joseph Kenyon	42	—
36. The methyl, ethyl, and isobutyl esters of di-trichloro-acetyltartaric acid, and the existence of minima in their temperature-rotation curves. By Thomas Stewart Patterson and Alfred Davidson	43	374
<i>March 7th.</i>		
37. Isomeric change of halogen-substituted diacylanilides into acylaminoketones. By Andrea Angel	46	515
38. Studies in the camphane series. Part XXXII. Stereoisomeric modifications of isonitroso-epicamphor, the third and fourth monoximes of camphorquinone. By Martin Onslow Forster and Hans Spiuner	46	1340
39. The synthesis of glyoxaline derivatives allied to pilocarpine. By Frank Lee Pyman	47	530
40. Calcium nitrate. Part I. The two-component system, calcium nitrate, water. Part II. The three-component system, calcium nitrate, nitric acid, water at 25°. By Henry Bassett, jun., and Hugh Stott Taylor	48	576
41. The chemistry of the glutaconic acids. Part III. Glutaconic acid and its β -alkyl derivatives. By Norman Bland and Jocelyn Field Thorpe	49	856
42. Asymmetric quinquivalent nitrogen compounds of simple molecular constitution. By William Jackson Pope and John Read	49	519
43. The interaction of phosphorus and potassium hydroxide solution. By Manindra Nath Banerjee	50	—
44. The triazo-group. Part XX. Azoimides of the propane series. By Martin Onslow Forster and John Charles Withers	50	489
45. Viscosity and association. Part II. The viscosity of geometrical isomerides. By Ferdinand Bernard Thole	51	552
46. The chemistry of the glutaconic acids. A correction. By Jocelyn Field Thorpe	51	—
47. The catalytic action of copper at 300° on some alcohols of the terpene group. By George Ballingall Neave	53	513
48. Preparation of the nitrites of the primary, secondary, and tertiary amines. Part II. By Pañchānan Neogi	53	1608
49. Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part III. By Pañchānan Neogi	53	1608
50. The glucoside and oil of <i>Caesalpinia bonducella</i> . By Kshitibhushan Bhaduri	53	—
51. Constituents of <i>Vernonia anthelmintica</i> . Part I. By Kshitibhushan Bhaduri	53	—

	Page in Pro- ceedings.	Page in Trans- actions.
52. Substituted isothiohydantoins. By Augustus Edward Dixon and John Taylor	54	558
53. The conversion of <i>d</i> -glucosamine into <i>d</i> -glucose. (Pre- liminary note.) By James Colquhoun Irvine and Alexander Hynd	54	—
54. The chemistry of the glutaconic acids. Part IV. The structure of the glutaconic acids. By Jocelyn Field Thorpe.....	55	871
55. Epicamphor (β -camphor). (Preliminary note.) By Julius Brecht and William Henry Perkin, jun	56	—
<i>March 21st.</i>		
56. Syntheses of 3-oxy-(1)-thionaphthen. By Archibald Moritz Hutchison and Samuel Smiles	62	570
57. The behaviour of metallic alloys when heated in a vacuum. By Clarence Richard Groves and Thomas Turner	62	585
58. The oxidation of atmospheric oxygen in presence of ozone. By Thomas Martin Lowry.....	64	1152
59. A method of producing a steady thallium flame. By Thomas Martin Lowry	65	—
60. Electro-reduction of alkylnitrosoamides. By Hilmar Johannes Backer	65	592
61. A model of an asymmetric carbon atom. By William Edward Garner	65	—
62. Organic derivatives of arsenic and antimony. (Pre- liminary note.) By Gilbert T. Morgan and Frances M. G. Micklethwait	68	—
63. <i>iso</i> Erucic acid. By Alexander Killen Macbeth and Alfred Walter Stewart	68	—
64. <i>p</i> -Hydroxystilbene and its derivatives. By Theodore Hewitt, William Lewcock, and Frank George Pope... ..	69	604
65. The chemistry of the glutaconic acids. Part. V. The esters of substituted glutaconic acids. By Norman Bland and Jocelyn Field Thorpe.....	70	871
66. The viscosity of compounds containing tervalent nitrogen. Part I. The amines. By Albert George Mussell, Ferdinand Bernard Thole, and Albert Ernest Dunstan	70	1008
67. The reciprocal influence of insaturated centres and its effect on the general absorptive power of compounds. By Alexander Killen Macbeth, Alfred Walter Stewart and Robert Wright	71	599
68. Experiments on a yellow colouring matter from ergot. By Albert Freeborn	71	—
69. The density of acetic acid. A correction. By William Robert Bousfield and Thomas Martin Lowry	72	—

	Page in Pro- ceedings.	Page in Trans- actions.
<i>April 18th.</i>		
70. Studies on platinocyanides. By Leonard Angelo Levy.	91	1081
71. Some reactions of β -naphthasulphonium-quinone. By Harold Christopher and Samuel Smiles.....	93	710
72. Asymmetric quaternary arsonium compounds and their attempted resolution. By Thomas Field Winmill ...	93	718
73. The condensation of ethyl sodiomalonate with ethyl citraconate and the synthesis of β -methyltricar- ballylic acid. By Edward Hope	93	892
74. The formation and hydrolysis of esters of ketonic acids By John Joseph Sudborough.	93	1227
75. Purpurogallin. Part II. By Arthur George Perkin ...	94	803
76. $\alpha\delta$ -Derivatives of adipic and β -methyladipic acids. (Pre- liminary note.) By Harold Davies, Henry Stephen, and Charles Weizmann.....	94	—
77. Triketomethylenedioxyhydrindene. By Siegfried Ruhe- mann	95	780
78. Aromatic antimony compounds. Part IV. Compounds of antimony trichloride with diazonium chlorides. By Percy May.....	96	1037
79. Note on the constituents of rhubarb. By Frank Tutin and Hubert William Bentley Clewer	96	—
80. Molecular-weight determinations from the relative lowering of the vapour pressure of ethereal solutions. By Robert Wright.....	96	—
81. Electrolytic reduction. Part I. Unsaturated aldehydes and ketones. By Herbert Drake Law	98	1016
82. A method of estimating potassium iodate. By James Eckersley Myers.....	99	—
83. The action of sodium hyposulphite on copper sulphate in aqueous solution. By James Brierley Firth and James Eckersley Myers.....	101	—
84. The action of chloral on ethyl tartrate and on ethyl malate. By Thomas Stewart Patterson and Andrew McMillan.....	101	788
85. The alkylation of the ferro- and ferri-cyanides. By Ernauld George Justinian Hartley	101	705
86. Nitrites of the alicyclic ammonium series- Part I. Nitrosopiperazinium nitrite. By Prafulla Chandra Rây and Jitendra Nath Rakshit	102	1*
87. The molecular conductivities of potassium nitrite, mercuric nitrite, and potassium mercurinitrite. By Prafulla Chandra Rây and Nilratan Dhar.....	102	965
88. A method of estimating tin in its ores, alloys, and compounds. By Manindra Nath Banerjee and Satish Chandra Banerjee	102	—
89. Condensation of acid chlorides with the ethyl esters of (a) cyanoacetic acid, (b) malonic acid, and (c) aceto- acetic acid. (Preliminary note.) By Charles Weiz- mann, Harold Davies, and Henry Stephen	103	—

	Page in Pro- ceedings.	Page in Trans- actions.
90. The rate of reduction of carbon dioxide by carbon. By Thomas Fred Eric Rhead and Richard Vernon Wheeler	104	831
91. The combustion of carbon. By Thomas Fred Eric Rhead and Richard Vernon Wheeler	105	846
92. The use of phenolphthalein as an indicator. The slow rate of neutralisation of carbonic acid. By James William McBain	106	814
93. Some hydroxy-ketonic dyes. By Jatindra Mohan Dutta and Edwin Roy Watson	106	1238
94. The externally compensated and optically active hydroxyhydrindamines, their salts and derivatives. By William Jackson Pope and John Read ..	107	758
95. The four stereoisomeric optically active 2 : 4-dimethyl-tetrahydroquinolines. By John Thomas	108	725
96. The optical activity of salts and derivatives of <i>d</i> -camphor- β -sulphonic acid. By Joseph Ivon Graham	108	746
97. Some mixed phosphonium derivatives. By William Jackson Pope and Charles Stanley Gibson	108	735
98. The alkaloidal salts of phenylmethylphosphinic acid. By William Jackson Pope and Charles Stanley Gibson ..	109	740
99. The state of ammonium in aqueous solution. By Thomas Field Winmill	109	1635
100. The absorption spectra of some metallic solutions. By Sir Walter Noel Hartley ...	109	820
101. The absorption spectra of permanganates. By Sir Walter Noel Hartley	109	826

* *May 2nd.*

102. Nor-hyoscyamine and nor-atropine ; alkaloids occurring in various solanaceous plants. By Francis Howard Carr and William Colebrook Reynolds	124	946
103. Researches on the constitution of physostigmine. Part I. By Arthur Henry Salway	125	978
104. The resolution of benzoylalanine into its optically active components. By William Jackson Pope and Charles Stanley Gibson	126	939
105. The "true" ionisation and hydration constants of ammonia and some amines, with a note on the formulation of nitrogen compounds. By Tom Sidney Moore	126	1635
106. The conversion of <i>d</i> -glucosamine into <i>d</i> -glucose. By James Colquhoun Irvine and Alexander Hynd	126	1128
107. The chlorination of iodophenols. Part I. The chlorination of <i>p</i> -iodophenol. By Sidney Albert Brazier and Hamilton McCombie	127	968
108. The monohalogen derivatives of acenaphthene. By Holland Crompton and Maggie Walker	127	958
109. Quinone-ammonium derivatives. Part I. The methylation products of picramic and isopicramic acids. By Raphael Meldola and William Francis Hollely	128	912

	Page in Pro- ceedings.	Page in Trans- actions.
110. Latent heats of vaporisation of mixed liquids. Part III. Mixtures of associated with non-associated liquids. New criteria for the detection of solvates in mixtures of liquids. By Daniel Tyrer	128	1104
111. Nickelo- and palladio-dithio-oxalic acids. By Humphrey Owen Jones and Charles Stanley Robinson	129	932
112. Dithiomalonates. By Humphrey Owen Jones and Charles Stanley Robinson	129	935
113. The "crude fat" of <i>Beta vulgaris</i> . By Allen Neville	130	1101
114. An experimental investigation of the bleaching process. Part II. The action of neutral salts on bleaching solutions. By Sydney Herbert Higgins	130	—
115. The chemistry of the aconitic acids. (Preliminary note.) By Norman Bland and Jocelyn Field Thorpe	131	—
<i>May 16th.</i>		
116. Aniline-black and allied compounds. Part II. By Arthur George Green and Arthur Edmund Woodhead	136	1117
117. Azo-dyestuffs of the triphenylmethane group. By Arthur George Green and Rajendra Nath Sen	137	1113
118. Investigations on the dependence of rotatory power on chemical constitution. Part III. The rotatory powers of <i>ac</i> -tetrahydro-2-naphthol and some of its esters. By Robert Howson Pickard and Joseph Kenyon	137	1427
119. Chemical examination of the bark of <i>Euonymus atropurpureus</i> . By Harold Rogerson	138	1040
120. Furan-2:5-dialdehyde. By William Francis Cooper and Walter Harold Nuttall	139	1074
121. Researches on santalin. Part I. Santalin and its derivatives. By John Cannell Cain and John Lionel Simonsen	139	1061
122. Action of Grignard reagents on esters of dibasic acids. (Preliminary note.) By John Theodore Hewitt and David Bernard Steinberg	140	—
123. The constitution of aminotyrosine and the action of oxydases on some tyrosine derivatives. By Casimir Funk	140	1004
124. The dynamic isomerism of ammonium thiocyanate and thiocarbamide. By William Ringrose Gelston Atkins and Emil Alphonse Werner	141	1167
125. Properties of mixtures of allyl alcohol and water. Part I. By Thomas Arthur Wallace and William Ringrose Gelston Atkins	141	1179
126. A modification of the Beckmann apparatus. By Edmund Knecht and John Percy Batey	142	1189
127. Alkaline cupri-compounds. By Spencer Umfreville Pickering	142	1614
128. The constituents of West Indian satinwood. By Samuel James Manson Auld and Samuel Shrowder Pickles	143	1052

	Page in Pro- ceedings.	Page in Trans- actions.
129. Optically active derivatives of <i>l</i> -methoxy- and <i>d</i> -dimethoxysuccinic acids. (Preliminary note.) By Charles Robert Young	143	—
130. The mechanism of the racemisation of some hydroxy-acids by heat. By Dan Ivor James and Humphrey Owen Jones	143	1158
131. The action of sodium hypobromite on carbamide derivatives. By Frank William Lynch	144	1755
132. Keto-enolic ethers and derivatives of dibenzoylmethane. By Robert Duncombe Abell	145	989
133. Derivatives of phenyl styryl ketone. Part I. The tautomeric forms of dibenzoylmethane. By Robert Duncombe Abell	145	998
134. The interaction between di-iodoacetylene and organic sodio-derivatives. By Hugh Vernon Thompson	146	—
135. The rotatory powers of the <i>d</i> - and <i>l</i> -methylethylphenacylthetine salts. By Clara Millicent Taylor	148	1124
<i>June 6th.</i>		
136. The vapour density of ammonium nitrite. By Prafulla Chandra Ray, Nilratan Dhar, and Tincowry De	151	1185
137. Pyrogenic decompositions. Part I. Benzene. By Clarence Smith and William Lewcock	152	1453
138. The absorption spectra of certain aromatic nitroamines and nitroamides. By Gilbert T. Morgan, Edgar Jobling, and Raymond T. F. Barnett	152	1209
139. The constitution of harmine. (Preliminary note.) By William Henry Perkin, jun., and Robert Robinson	153	—
140. The synthesis of isoharman. (Preliminary note.) By William Henry Perkin, jun., and Robert Robinson	154	—
141. Blue adsorption compounds of iodine. Part I. Starch, saponarin and cholalic acid. By George Barger and Ellen Field	157	1394
142. The absorption spectra of various derivatives of naphthalene in solution and as vapours. By John Edward Purvis	157	1315
143. The velocity of the hydrogen ion and a general dissociation formula for acids. By James Kendall	158	1275
144. <i>N</i> -Chloro-derivatives of benzyldiene-diamides. By Frederick Daniel Chattaway and Alan Edulf Swinton	158	1206
145. The refractivity of sulphur in various aliphatic compounds. By Thomas Slater Price and Douglas Frank Twiss	159	1259
146. The conditions of isodynamic change in the aliphatic ketones. Part I. The autocatalytic reaction between acetone and iodine. By Harry Medforth Dawson and Frank Powis	159	1503
147. Tyrosine and its derivatives containing substituents in the benzene ring. (Preliminary note.) By Henry Stephen and Charles Weizmann	160	—

	Page in Pro- ceedings.	Page in Trans- actions.
148. Configuration of the stereoisomeric dibromosuccinic acids. By Alex. McKenzie	160	1196
149. The exhaustive alkylation of tetrahydroberberine. By James Wallace McDavid, William Henry Perkin, jun., and Robert Robinson	160	1218
150. The spectroscopic investigation of the carbinol-ammonium base isomerism. Benziminazole and isoquinoline derivatives. By Charles Kenneth Tinkler.	161	1245
151. Some derivatives of oxazole. By Joseph Lister and Robert Robinson	162	1297
152. Electrolytic reduction. Part VII. The catalytic action of copper. By Herbert Drake Law	162	1544
153. The two sulphides of β -naphthol. By Cecil Reginald Crymble, Kenneth Ross, and Samuel Smiles	162	1146
154. α -Hydroxyhippuric acid and a new test for hippuric acid. By Paul Haas	163	1254
155. The constitution of the aldol bases. By Muriel Gwendolen Edwards, Ralph Eddowes Garrod, and Humphrey Owen Jones	163	1376
156. Some quinoline and tetrahydroquinoline derivatives obtained from aldol bases. By Ralph Eddowes Garrod, Humphrey Owen Jones, and Percy Edwin Evans	164	1389
157. The viscosity of ether-alcohol mixtures. By Frank Baker	165	1409
158. Morphotropic relationships between racemic compounds and their optically active components. By George Jerusalem	165	1268
159. The action of sodium methoxide on 2:3:4:5-tetrachloropyridine. Part I. By William James Sell ...	165	1193
<i>June 20th.</i>		
160. The formation of neon as a product of radioactive change. By Sir William Ramsay, K.C.B.	182	1367
161. An analysis of the waters of the thermal springs of Bath. By Irvine Masson and Sir William Ramsay K.C.B.	183	1370
162. The colour intensity of copper salts. By Spencer Umfreville Pickering	184	1625
163. Nitrites of the mercurialkyl- and mercurialkylaryl-ammonium series. Part II. By Prafulla Chandra Rây, Nilratan Dhar, and Tincowry De	185	1552
164. Studies of dynamic isomerism. Part XIII. Camphor-carboxylamide and camphorcarboxypiperidide. An illustration of Barlow and Pope's hypothesis. By Walter Hamis Glover and Thomas Martin Lowry ...	185	1902
165. Studies of dynamic isomerism. Part XIV. Successive isomeric changes in camphorcarboxylamide and camphorcarboxypiperidide. By Thomas Martin Lowry and Walter Hamis Glover	186	—
166. The continuous fractional distillation of water. By William Robert Bousfield	186	1443

	Page in Pro- ceedings.	Page in Trans- actions.
167. Studies on certain aliphatic hydroxy-acids. By Henry John Horstman Fenton and William Arthur Reginald Wilks	187	1570
168. Formation of seven- and eight-membered rings from 2:2'-ditolyl. By James Kenner	187	—
169. Contributions to the chemistry of the terpenes. Part XIII. The preparation of pure bornylene. By George Gerald Henderson and William Caw	187	1416
170. The interaction of bromine and the sulphides of β -naphthol. By Thomas Joseph Nolan and Samuel Smiles	188	1420
171. The absorption spectra of some substances containing two benzene nuclei. By John Edward Purvis and Nial Patrick McClelland	188	1514
172. The influence of the constitution of tertiary bases on the rate of formation of quaternary ammonium salts. (Preliminary note.) By Ebenezer Rees Thomas	188	—
173. An easily adjustable vapour thermostat. By James Fletcher and Daniel Tyrer	189	—
174. Contributions to our knowledge of semicarbazones. Part I. Semicarbazones of phenyl styryl ketone. By Isidor Morris Heilbron and Forsyth James Wilson	192	1482
175. The essential oil of "Nepal sassafras" or "Nepal camphor" tree. By Samuel Shrowder Pickles.....	192	1433
176. The addition of hydrocyanic acid to derivatives of glutaric acid and itaconic acid. (Preliminary note.) By Edward Hope	192	—
177. The possible limitation of molecular magnitude. By Holland Crompton	193	—
178. The products of the oxidation of chloroacenaphthene with chromic acid. By Holland Crompton and Wilhelmina Rebecca Smyth	194	—
179. The influence of colloids and fine suspensions on the solubility of gases in water. Part II. Solubility of carbon dioxide and of hydrogen. By Alexander Findlay and Buechok Shen	195	1459
180. The chemistry of the aconitic acids, Part I. The labile modification of aconitic acid and the hydroxy-anhydro-acid. By Norman Bland and Jocelyn Field Thorpe	195	1490
181. The action of bromine on cholesteryl benzoate. (Preliminary note.) By Charles Dorée and Charles Stotensbury	196	—
182. A theory of fluorescence. By Edward Charles Cyril Baly and Rudolf Krulla	196	1469
183. Chemical reactivity and absorption spectra. Part I. By Edward Charles Cyril Baly and Francis Owen Rice	197	1475
184. The wet oxidation of metals. Part II The rusting of iron (continued). By Bertram Lambert	197	2056
185. Colouring matters of the flowers of the <i>Cedrela toona</i> . By Arthur George Perkin	198	1538
186. The so-called manganese trioxide. (Preliminary note.) By Frederick Russell Lankshour	198	—

	Page in Pro- ceedings.	Page in Trans- actions.
187. Co-ordination compounds of vanadium. (Preliminary note.) By Gilbert T. Morgan and Henry Webster Moss.....	199	—
188. Substituted thiolazo-derivatives of benzene. By John Jacob Fox and Frank George Pope	200	1498
<i>Papers received during the vacation and published, or passed for publication, in the Transactions:</i>		
189. The essential oil of the leaves of <i>Atherosperma moschatum</i> (Australian sassafras). By Margaret Eunilie Scott	217	1612
190. Harmine and harmaline. Part I. By William Henry Perkin, jun., and Robert Robinson	217	1775
191. The chemistry of the glutaconic acids. Part V. The preparation of esters of the labile acids. By Norman Bland and Jocelyn Field Thorpe.....	217	1557
192. The chemistry of the glutaconic acids. Part VI. Conditions which confer stability on the <i>trans</i> -forms of the labile acids. By Norman Bland and Jocelyn Field Thorpe	218	1739
193. 4-Alkyl-1 : 4-thiazans. By Hans Thacher Clarke.....	218	1583
194. The triazo-group. Part XXI. Benzenoid azoinides containing multivalent iodine. By Martin Onslow Forster and Johannes Heinrich Schaeppi	219	1359
195. β -Hydroxy- $\alpha\beta$ -dimethyladipic acid and β -hydroxy- $\alpha\alpha\beta$ -trimethyladipic acid. By Victor John Harding	219	1590
196. The migration of the para-halogen atom in phenols. By Philip Wilfred Robertson and Henry Vincent Aird Briscoe	219	1964
197. The resolution of <i>sec.</i> -butylamine into optically active components. By William Jackson Pope and Charles Stanley Gibson	220	1702
198. The relation between residual affinity and chemical constitution. Part III. Some heterocyclic compounds. By Hans Thacher Clarke	220	1788
199. The configuration of substituted ammonium compounds. By Humphrey Owen Jones and John Gunning Moore Dunlop.....	221	1748
200. Hydrolysis of acetic anhydride. By Kennedy Joseph Previté Orton and Marian Jones	221	1708
201. Acetic anhydride. The pure material, its physical properties, and its reaction with bromine. By Kennedy Joseph Previté Orton and Marian Jones ...	222	1720
202. The action of sulphur on amines. Part I. <i>o</i> -Toluidine. By Herbert Henry Hodgson	222	1693
203. Acyl derivatives of the dihydroresorcins. Part I. The action of hydroxylamine and of phenylhydrazine on <i>C</i> -acetyl dimethyl- and <i>C</i> -acetyl trimethyl-dihydroresorcins. By Arthur William Crossley and Nora Renouf.....	223	1524

	Page in Pro- ceedings.	Page in Trans- actions.
204. The influence of solvents on the rotation of optically active compounds. Part XVIII. The effect of inorganic salts on the rotation of ethyl tartrate in aqueous solution and in the homogeneous condition. By Thomas Stewart Patterson and Duncan Geddes Anderson.....	224	1833
205. The action of aliphatic amines on <i>s</i> -dibromosuccinic acid. Part II. Allylamine. By Edward Percy Frankland and Henry Edgar Smith.....	224	1724
206. Studies on cyclic ketones. Part I. By Siegfried Ruhemann	224	1729
207. The bromination of phenol. 2 : 4- and 2 : 6-Dibromophenol. By Frank George Pope and Arthur Samuel Wood	225	1823
208. The action of halogens on silver salts and on potassium cyanate in presence of water, with a note on the decomposition of cyanic acid in aqueous solution. By Charles William Blyth Normand and Alexander Charles Cumming	225	1852
209. The refraction and dispersion of triazo-compounds. Part II. By James Charles Philip	226	1866
210. The action of acyl chlorides on primary amides. By Arthur Walsh Titherley and Thomas Halstead Holden	227	1871
211. The action of benzotrichloride on primary anides. By Arthur Walsh Titherley and Thomas Halstead Holden.....	227	1881
212. <i>iso</i> Quinoline derivatives. Part VII. The preparation of hydrastinine from cotarnine. By Frank Lee Pyman and Frederic George Percy Remfry	228	1595
213. The rate of reaction of alkyl haloids with certain tertiary bases. By Richard William Dades Preston and Humphrey Owen Jones	229	1930
214. Derivatives of <i>o</i> -hydroxyazobenzene. By John Theodore Hewitt and William Henry Ratcliffe.....	229	1765
215. The absorption spectra of nitro-compounds. By John Theodore Hewitt, Frank George Pope, and Winifred Isabel Willett	230	1770
216. A study of some bicyclic quaternary ammonium compounds. By John Gunning Moore Dunlop	230	1998
217. 3-Aminocoumarin. By Frank William Linch	230	1758
218. Studies in the azine series. Part II. By Kathleen Balls, John Theodore Hewitt, and Sidney Herbert Newman	231	1840
219. Properties of mixtures of allyl alcohol, water, and benzene. Part II. By Thomas Arthur Wallace and William Ringrose Gelston Atkins	231	1958
220. Some new diazoamino- and <i>o</i> -aminoazo-compounds. By George Marshall Norman	232	1913
221. The alkaline condensations of nitrohydrazo-compounds. Part II. By Arthur George Green and Frederick Maurice Rowe.....	233	2003
222. The absorption spectra of simple aliphatic substances in solutions, vapours, and thin films. Part I. Saturated aldehydes and ketones. By John Edward Purvis and Nial Patrick McClelland	233	1810

	Page in Pro- ceedings.	Page in Trans- actions.
223. The influence of certain salts on the dynamic isomerism of ammonium thiocyanate and thiocarbamide. By William Ringrose Gelston Atkins and Emil Alphonse Werner	233	1982
224. The molecular condition of some organic ammonium salts in bromoform. By William Ernest Stephen Turner	234	1923
225. The action of sodium methoxide on 2:3:4:5-tetra-chloropyridine. Part II. By William James Sell ...	234	1945
226. The preparation of glycogen and yeast-gum from yeast. By Arthur Harden and William John Young	235	1928
227. Studies of Chinese wood oil. β -Elæostearic acid. By Robert Selby Morrell	235	2082
228. The constitution of camphene. Part I. The structure of camphenic acid. By Walter Norman Haworth and Albert Theodore King	236	1975
229. Studies in phototropy and thermotropy. Part III. Arylideneamines. By Alfred Senier, Frederick George Shephard, and Rosalind Clarke	236	1950
230. Studies of the constitution of soap in solution: sodium myristate and sodium laurate. By James William McBain, Elfreida Constance Victoria Cornish, and Richard Charles Bowden	237	2042
231. The condensation of α -keto- β -anilino- $\alpha\beta$ -diphenylethane its homologues with ethyl chlorocarbonate and thionyl chloride. By Hamilton McCombie and John Wilfred Purkes	238	1991
232. Carbon disulphide as solvent for the determination of the "refraction constant." By Frédéric Schwes	239	1889
233. The electrochemistry of solutions in acetone Part II. The silver nitrate concentration cell. By Alexander Roshdestwensky and William Cudmore McCullagh Lewis	239	2094
234. The influence of neutral solvents on velocity of reaction. Part II. Transformation of anissynaloxime in various solvents. By Thomas Stewart Patterson and Harvey Hugh Montgomerie	240	2100
235. The condensation of pentaerythritol with aldehydes. By John Read	240	2090
236. The interaction of iodine and thiocarbamide. The properties of formamidine disulphide and its salts. By Emil Alphonse Werner	240	2166
237. The action of nitrous acid on thiocarbamide and on formamidine disulphide A new structural formula of thiocarbamide. By Emil Alphonse Werner	241	2180
238. The oxidation of some benzyl compounds of sulphur. Part I. By John Armstrong Smythe	242	2076
239. The synthetical production of derivatives of dinaphth-anthracene. By William Hobson Mills and Mildred Mills	242	2194
240. The preparation of durylic and pyromellitic acids. By William Hobson Mills	243	2191

	Page in Pro- ceedings.	Page in Trans- actions.
241. Organic derivatives of silicon. Part XV. The nomenclature of organic silicon compounds. By Frederic Stanley Kipping	243	2106
242. Organic derivatives of silicon. Part XVI. The preparation and properties of diphenylsilicanediol. By Frederic Stanley Kipping	243	2108
243. Organic derivatives of silicon. Part XVII. Some condensation products of diphenylsilicanediol. By Frederic Stanley Kipping	244	2125
244. Organic derivatives of silicon. Part XVIII. Dibenzylsilicanediol and its anhydro-derivative. By Robert Robison and Frederic Stanley Kipping	245	2142
245. Organic derivatives of silicon. Part XIX. The preparation and properties of some silicanediols of the type $\text{SiR}_2(\text{OH})_2$. By Robert Robison and Frederic Stanley Kipping	245	2156
246. The purification, density, and expansion of ethyl acetate. By John Wade and Richard William Merriman	246	2429
247. The vapour pressure of ethyl acetate from 0° to 100° . By John Wade and Richard William Merriman	246	2438
248. Halogen derivatives and "refraction constant." By Frédéric Schwes	246	—
249. Bimolecular glycollaldehyde. A correction. By Nial Patrick McClelland	247	—

November 7th.

250. Aniline-black and allied compounds. Part III. By Arthur George Green and Salomon Wolff	250	—
251. The alkaline condensation of nitrohydrazo-compounds. Part III. Influence of ortho-groups on their formation and condensation. By Arthur George Green and Frederick Maurice Rowe	251	2443
252. The existence of quinonoid salts of <i>o</i> -nitroamines and their conversion into oxadiazole oxides. By Arthur George Green and Frederick Maurice Rowe	252	2452
253. The essential oil of cocoa. By James Scott Bainbridge and Samuel Henry Davies	253	2209
254. Studies in chemical crystallography. Part I. Coordination, isomorphism, and valency. By Thomas Vipond Barker	253	2484
255. The oxidation of aconitine. By Francis Howard Carr	253	2241
256. Some time-reactions suitable for lecture experiments. By William Gerald Glendinning and Alfred Walter Stewart	254	—
257. The problem of strong electrolytes. (Preliminary note.) By James Kendall	255	—
258. Action of semicarbazide hydrochloride on the <i>p</i> -quinones. (Preliminary note.) By Isidor Morris Heilbron and James Alexander Russell Henderson ...	256	—

	Page in Pro- ceedings.	Page in Trans- actions.
259. The interaction of azoimide and nitrous acid. Preliminary note.) By Emil Alphonse Werner	257	—
260. Benzylmethyl-, benzylethyl-, and allyl-ammonium nitrites. By Prafulla Chandra Rây and Rasik Lal Datta	258	—
261. Note on the action of ethylene oxide on hydrazine hydrate. By Edward de Barry Barnett	259	—
262. Note on the hydrolysis of acetic anhydride. By James Charles Philip	259	—
263. Condensation of bromoacyl haloids with glucosamine. (Preliminary note.) By Arthur Hopwood and Charles Weizmann	261	—
264. Note on the formation of tetrachlorophthalyl chloride by chlorination of tetrachlorophthalide. By William Hobson Mills and Walter Henry Watson	262	—
265. Note on the preparation and properties of sulphonic esters. By John Ferns and Arthur Lapworth	263	—
266. Electromotive forces in alcohol. Part III. Further experiments with the hydrogen electrode in dry and moist alcoholic hydrogen chloride. By Robert Taylor Hardman and Arthur Lapworth.....	263	2249
267. The properties of α -bromonaphthalene. By John Ickeringill Crabtree and Arthur Lapworth	264	—
268. Absorption spectra of the cobalto-derivatives of primary aliphatic nitroamines. By Antoine Paul Nicolas Franchimont and Hilmar Johannes Backer	264	2256
269. The constituents of <i>Cluytia similis</i> . By Frank Tutin and Hubert William Bentley Clewer	265	2221
270. The constitution and reactions of thiocarbamides. By Augustus Edward Dixon and John Taylor.....	265	2502
271. The effect of heat on a mixture of benzaldehydecyanohydrin with <i>m</i> -chloroaniline and <i>m</i> -toluidine. By Clement William Bailey and Hamilton McCombie ...	266	2272
272. Pilosine: a new alkaloid from <i>Pilocarpus microphyllus</i> . By Frank Lee Pyman	267	2260
273. Note on the alkaloids of <i>Pilocarpus racemosus</i> . By Hooper Albert Dickinson Jowett and Frank Lee Pyman	268	—
274. The ignition of electrolytic gas by the electric discharge. By Hubert Frank Coward, Charles Cooper, and Christopher Henry Warburton	268	2278
275. The relation between viscosity and chemical constitution. Part V. The viscosity of homologous series. By Albert Ernest Dunstan and Ferdinand Bernard Thole	269	—
276. The relation between viscosity and chemical constitution. Part VI. Viscosity an additive function. By Albert Ernest Dunstan and Ferdinand Bernard Thole	269	127*
277. The relation between viscosity and chemical constitution. Part VII. The effect of the relative position of two unsaturated groups on viscosity. By Albert Ernest Dunstan, Thomas Percy Hilditch, and Ferdinand Bernard Thole	269	133*

	Page in Pro- ceedings.	Page in Trans- actions.
278. Contributions to the chemistry of the terpenes. Part XIV. The oxidation of pinene with hydrogen peroxide. By George Gerald Henderson and Maggie Millen Jeffs Sutherland	270	2288
279. Baly and Krulla's hypothesis of fluorescence. By Alexander Killen Macbeth	271	—
280. Hydrazoximes of benzil and diacetyl. By Martin Onslow Forster and Biman Bihari Dey	275	2234
281. The relation between constitution and rotatory power amongst derivatives of tetrahydroquinaldine. By William Jackson Pope and Thomas Field Winmill ...	275	2309
282. The dehydration of α - β -naphthol sulphide. By Kenneth Ross and Samuel Smiles	275	—
283. Salts of naphthathioxonium. (Preliminary note.) By Thomas Joseph Nolan and Samuel Smiles	276	—
284. Intramolecular rearrangements of <i>o</i> -sulphoxides of diphenylamine. Part IV. By Thomas Percy Hilditch and Samuel Smiles	276	2294
285. Diphenyl-2:3:2':3'-tetracarboxylic acid. (Preliminary note.) By James Kenner	277	—
286. The reactions of dibenzocycloheptadienone. (Preliminary note.) By James Kenner and Emily Gertrude Turner	277	—
287. Studies in the diphenylseries. Part II. The dinitrobenzidines: a new form of isomerism. By John Cannell Cain, Albert Coulthard, and Frances Mary Gore Mickelthwait	277	2298
288. The velocity of reaction between potassium chloroacetate and some aliphatic amines. By Tom Sidney Moore, Donald Bradley Somervell, and John Newton Derry	278	2459
289. The absence of optical activity in the α - and β -2:5-dimethylpiperazines. By William Jackson Pope and John Read	278	2325

November 21st.

290. The change in the boiling points of the trioxide and tetroxide of nitrogen on drying. By Herbert Brereton Baker and Muriel Baker	282	2339
291. The tendency of atomic weights to approximate to integral and semi-integral values. By Ernest Feilmann	283	—
292. The constituents of taraxacum root. By Frederick Belding Power and Henry Browning, jun.	285	2411
293. Studies in the diphenyl series. Part III. Diphenyl-diphthalamio acids and pyronine colouring matters containing the diphenyl group. By John Cannell Cain and Oscar Lisle Brady	285	2304
294. Viscosity and association. Part III. The existence of racemic compounds in the liquid state. By Ferdinand Bernard Thole	286	19*

	Page in Pro- ceedings.	Page in Trans- actions.
295. The condensation of α -keto- β -anilino- $\alpha\beta$ -diphenyl- ethane and its homologues with phenylcarbimide and with phenylthiocarbimide. By Sidney Albert Brazier and Hamilton McCombie	287	2352
296. The influence of the sodium salts of organic acids on the rate of hydrolysis by alkali. By George Senter and Fritz Bulle	288	2528
297. Photo-kinetics of sodium hypochlorite solutions. By William Cudmore McCullagh Lewis	288	2371
298. The constitution of aconitine. (Preliminary note.) By Oscar Lisle Brady	289	—
299. Properties of mixtures of ethyl alcohol, carbon tetrachloride, and water. By Thomas Henry Hill ...	290	2467
300. The behaviour of brass on heating in hydrogen at temperatures below the melting point. By Ernest Alfred Lewis	290	—
301. Inositol and some of its isomerides. By Hugo Müller	291	2383
302. The catalytic decomposition of nitrosotriacetoneamine by alkalis. By Douglas Arthur Clibbens and Francis Francis	291	2358
303. Chlorides of the mercurialkyl- and mercurialkylaryl- ammonium series, and their constitution as based on conductivity measurements. By Prafulla Chandra Ray and Nilratan Dhar	292	3*
304. Position-isomerism and optical activity; halogen derivatives of methyl dibenzoyltartrate. By Percy Faraday Frankland, Sidney Raymond Carter, and Ernest Bryan Adams	292	2470
305. Reactivity of the halogens in organic compounds. Part VII. The formation of intermediate compounds in the hydrolysis of sodium bromoacetate. By George Senter and Thomas John Ward	293	2534
306. 2-Phenyl-1:4:5:6-tetrahydropyrimidine and benzoyl- $\alpha\gamma$ -diaminopropane. By Gerald Eyre Kirkwood Branch and Arthur Walsh Titherley	293	2342
307. The magnetic rotation of binary mixtures. By Frédéric Schwes	294	—
<i>December 5th.</i>		
308. Chemical reactivity and absorption spectra. Part II. The variation in absorption produced by a solvent. By Edward Charles Cyril Baly and Francis Owen Rice	312	91*
309. Studies in the camphane series. Part XXXIII. Orientation of Tiemann's isocaminocamphor. By Martin Ouslow Forster and Hubert Arthur Harry Howard	313	63*
310. A study of some organic derivatives of tin as regards their relation to the corresponding silicon compounds. By Thomas Alfred Smith and Frederic Stanley Kipping	313	2553

	Page in Pro- ceedings.	Page in Trans- actions.
311. Contributions to the chemistry of the terpenes. Part XV. Synthesis of a menthadiene from carvacrol. By George Gerald Henderson and Schachno Peisach Schotz	314	2563
312. The action of halogens on silver salts. By Hugh Stott Taylor.....	314	31*
313. The formation of tetrahydro-oxazoles from α -hydroxy- β -anilino- $\alpha\beta$ -diphenylethane and its homologues. By Horace Leslie Crowther and Hamilton McCombie	315	27*
314. The precipitation of lead thiosulphate and its behaviour on boiling with water. By William Hughes Perkins and Albert Theodore King	315	—
315. Studies on cyclic ketones. Part II. By Siegfried Ruhemann and Stanley Isaac Levy	316	2542
316. Some hydrogen ferrocyanides. By Herbert Ernest Williams	317	—
317. The formulæ of ipuranol and some related compounds. By Frank Tutin and Hubert William Bentley Clewer	317	—
318. Equivalent conductivity and ionisation of nitrites. By Prafulla Chandra Rây and Nilratan Dhar	319	10*
319. The latent heats of chloroform and benzene and of their mixtures between 0° and 80°. By James Fletcher and Daniel Tyrer	319	—
320. Synthetic aminoglucosides derived from <i>d</i> -glucosamine. By James Colquhoun Irvine and Alexander Hynd ...	319	41*
<i>December 19th.</i>		
321. A qualitative attempt to harmonise the relation between temperature and rotation for light of all refrangibilities of certain active substances, both in the homogeneous state and in solution. By Thomas Stewart Patterson	324	145*
322. The photography of absorption spectra. By Thomas Ralph Merton	325	124*
323. The constitution of ortho-diazoimines. Part II. The <i>p</i> -tolynaphthatriazoles. By Gilbert T. Morgan and Frances Mary Gore Micklethwait	325	71*
324. Co-ordination compounds of vanadium. Part I. The acylacetates. By Gilbert T. Morgan and Henry Webster Moss	325	78*
325. Dibenzyl- and diphenyl-silicols and -silicones. By Geoffrey Martin	326	119*
326. Optically active glycols derived from the phenyl-lactic acids. Part I. By Alex. McKenzie and Geoffrey Martin	326	112*
327. Diphenylene. Part II. By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge	327	36*
328. A new method for the estimation of hypochlorites. By Herbert Goulding Williams	327	—

	Page in Pro- ceedings.	Page in Trans- actions.
329. Ethylation in the flavone group. By Arthur George Perkin	328	—
330. The synthesis of some new dimethyltetrahydroquinolines. By Arthur James Ewins and Harold King ...	328	104*
331. The constitution of cytisine, the alkaloid of <i>Cytisus laburnum</i> . Part I. The synthesis of α -cytisolidine and of β -cytisolidine. By Arthur James Ewins	329	97*
332. Some reactions of the sulphonylic acids. By Percy May and Samuel Smiles	329	—
333. The condensation of α -keto- β -anilino- α -phenylethane and its homologues with carbonyl chloride, phenylcarbimide, and phenylthiocarbimide. By Hamilton McCombie and Harold Archibald Scarborough	331	56*
334. Note on the nitration of <i>p</i> -hydroxyacetophenone. By Frank Geo. Pope	331	—
335. Bromoxlenols obtained from dimethyldihydroresorcin. (Preliminary note.) By Arthur William Crossley and Sydney Smith	332	—
336. Non-aromatic diazonium salts. (Preliminary note.) By Gilbert T. Morgan and Joseph Reilly	334	—
EXTRA MEETINGS.		
March 25th.—Annual General Meeting	75	639
October 17th.—Becquerel Memorial Lecture	247	2005

* Papers printed in the Transactions for 1913 are distinguished by an asterisk after the Page number. Where no reference is given to the Transactions, the paper has so far appeared only in the Proceedings.

LIBRARY RULES.

1. The Library is open for reference, and for the issue and return of books, daily from 10 a.m. to 6 p.m. (Saturdays 10 a.m. to 2 p.m.); and in the evenings of those days on which the Chemical Society meets.

2. Fellows are not allowed to have on loan more than *six* volumes at a time, without special permission from the Librarian.

3. All Journals, Dictionaries, and Pamphlets of which there are not duplicate copies, and certain early Chemical and other Books distinguished in the Library Catalogue by a star, belong to the Reference Library, and are not for general circulation. Fellows desiring to borrow books from the Reference Library must make a special application in writing to the Librarian, undertaking to bear all risks of transit, &c., and to return the volumes within one month; the Librarian may then, at his discretion, issue such books. This regulation does not apply, however, to volumes of Periodicals of which no duplicate copies exist in the Library.

4. A book may not be taken out of the Library until one month after it has been received.

5. Books must not be removed from the Library until a voucher for them has been signed and delivered to the Librarian.

6. Books are issued either to the Fellow desiring the loan, or to a person bringing a written order from him. In either case a receipt must be given on the form provided. When a Fellow desires a book or books to be sent to him, he must send to the Librarian a written order, and pay the whole cost of carriage. All books borrowed by Fellows shall be at the risk of the borrower from the moment they are issued or despatched by the Librarian, and until they are returned to him.

7. Books may not be sent out of the United Kingdom.

8. Books which have been bespoken shall circulate in the order of application.

9. Fellows shall be at liberty to retain a book one calendar month, unless, at the expiration of a fortnight, notice is received that the book is required by another Fellow, in which case it must be returned at once. Single parts of journals may not be retained longer than one week.

10. The names of Fellows borrowing books shall be entered by the Librarian, or Officer in attendance, in a book kept for that purpose. When a Fellow returns a book, his voucher shall be given to him, and a record of the return duly made.

11. In the case of Fellows returning books by messenger or public conveyance, the voucher shall be returned by the Librarian through the post.

12. Fellows retaining books longer than the time specified, or neglecting to return them when demanded, shall forfeit the right to borrow books from the Library until the volume or volumes be returned.

13. Fellows to whom books have been issued shall be held responsible for their preservation from injury; and if any book when returned is found to have been damaged, the Council may order that it be repaired or replaced at the expense of the borrower. In the event of any book being lost, or being detained after application has been made for its return, the Council may replace, at the cost of the borrower, the volume or volumes so lost or detained. This rule shall also apply to single parts of current periodicals.

14. For the purpose of revision and cleaning, the Library shall be closed for a fortnight in August of each year; before which time all books must be returned, unless special permission has been previously obtained from the Librarian. In the event of any book not being returned on such occasion, the Council may replace it at the cost of the borrower.

15. No persons other than Fellows of the Society have the privilege of using the Library, except upon a written introduction from a Fellow, with whom rests the responsibility for all books consulted by the person introduced. Such introduction shall be valid for one occasion only.

ADDITIONS TO THE LIBRARY DURING THE YEAR 1912.

Abderhalden, Emil [Editor]. *Biochemisches Handlexikon*. Vols. I to VII. i. Berlin 1911. (*Reference.*)

— *Handbuch der biochemischen Arbeitsmethoden*. Vol. V. ii. Wien 1912.

Aberdeen, University of. Subject catalogue of the Phillips Library of Pharmacology and Therapeutics. Aberdeen 1911. pp. 240.

Accum, Fredrick. A treatise on adulterations of food, and culinary poisons, exhibiting the fraudulent sophistications . . . and methods of detecting them. London 1820. pp. xvi + 372. (*Reference.*)

Allen, Alfred Henry. Commercial organic analysis. Vol. VI. 4th edition. Edited by *William Alfred Davis* and *Samuel S. Sadtler*. London 1912. pp. ix + 726. (*Reference.*)

Allmand, Arthur John. The principles of applied electrochemistry. London 1912. pp. xii + 547. ill.

American Society for Testing Materials. Memorial volume commemorative of the life and life-work of Charles Benjamin Dudley. Philadelphia, Pa. [n.d.]. pp. 269. ill.

Angeli, A. *Neue Studien in der Indol- und Pyrrolgruppe*. (Sammlung, Vol. XVII.) Stuttgart 1911.

Anschütz, Richard. See Couper, *Archibald Scott*.

Archbutt, Leonard, and Deeley, R. Mountford. Lubrication and lubricants. A treatise on the theory and practice of lubrication, and on the nature, properties, and testing of lubricants. 3rd edition. London 1912. pp. xxxvi + 599. ill.

Armstrong, Edward Frankland. The simple carbohydrates and the glucosides. 2nd edition. London 1912. pp. viii + 171.

Arrhenius, Svante. Theories of solutions. New Haven 1912. pp. xx + 247.

Auerbach, Friedrich, and Pick, Hans. Die Alkalität wässriger Lösungen kohlensaurer Salze. (From the *Arbeit. K. Gesundheitsamte*. 1911, 38.)

Auld, Samuel James Manson. An introduction to quantitative analysis. London 1912. pp. x + 215. ill.

Autenreith, W., and Funk, Albert. Ueber die kolorimetrische Bestimmung des Milchzuckers im Harn und in der Milch. (From the *München. med. Wochensch.*, No. 32, 1911.)

— and **Müller, Gerhard.** Ueber die kolorimetrischen Bestimmungen des Zuckers, Kreatins und Kreatinins im Harn. (From the *München. med. Wochensch.*, No. 17, 1911.)

Backer, Hilmar Johannes. Die Nitramine und ihre Isomeren. (Sammlung, Vol. XVIII.) Stuttgart 1912.

Ball, John. The meteorite of El Nakhla el Baharia. pp. 20. Cairo 1912.

Bang, Ivar. Ueber den chemischen Vorgang bei der Milchgerinnung durch Lab. (From the *Skand. Arch. Physiol.*, 1911, 25.)

Barclay, William R., and Hainsworth, Cecil H. Electroplating. A treatise on the electro-deposition of metals, with a chapter on metal-colouring and bronzing. London 1912. pp. viii + 399. ill.

Barger, George, and Dale, Henry Hallett. β -Iminazolyethylamine a depressor constituent of intestinal mucosa. (From the *J. Physiol.* 1911, 41.)

Bayliss, William Maddock. The nature of enzyme action. 2nd edition. London 1911. pp. xi + 137.

Bechhold, H. Die Kolloide in Biologie und Medizin. Dresden 1912. pp. xii + 441. ill.

Beckurts, H., and Lüning, O. Die Methoden der Massanalyse. Part II. Braunschweig 1912. pp. ix + 483 to 842. ill.

Benjamin, Marcus. American art pottery. (From the *Glass and Pottery World*, 1907.)

Bigelow, S. Lawrence. Theoretical and physical chemistry. New York 1912. pp. xiii + 544. ill.

Bird, William H. See Institute of Brewing.

Blount, Bertram. Lectures on cement. pp. 64. ill. London 1912.

Bolton, Edward Richards, and Revis, Cecil. Fatty foods, their practical examination. A handbook for the use of analytical and technical chemists. London [1912]. pp. x + 371. ill.

Bristol and Clifton Hotwells. A few words on the Bristol and Clifton Hotwells. Together with an analysis of the Spa by William Herapath. Bristol [1854]. pp. 24.

Bruce, W. Report on cattle-feeding experiments with soya-bean cake. (*Edinburgh and East of Scotland Coll. of Agric., Report*, 25. 1911.)

Burgess, George K., and Le Chatelier, Henri Louis. The measurement of high temperatures. 3rd edition. New York 1912. pp. xviii + 510. ill.

Burgess, George K. See Waidner, C. W.

Caccia, *Piero*. See Patta, *Aldo*.

Cameron, *Frank K.* The soil solution: the nutrient medium for plant growth. Easton, Pa. 1911. pp. vi + 136.

Cathcart, *E. P.* The physiology of protein metabolism. London 1912. pp. viii + 142.

Chacón, *Aníbal*. La molécule cyclique. Une nouvelle hypothèse sur le benzène allotropie et polymérie. Montevideo 1911. pp. 43.

Chapman, *Alfred Chaston*. Brewing. Cambridge 1912. pp. xii + 130. ill.

The Chemical World. A monthly journal of chemistry and chemical engineering. Vol. I, No. I, etc. London 1912. ill. (*Reference.*)

Church, *Sir Arthur Herbert*. Church's laboratory guide. A manual of practical chemistry . . . specially arranged for agricultural students. Revised and partly rewritten by *Edward Kinch*. 9th edition. London 1912. pp. xvi + 368. ill.

Clarkson, *S. S.* See Dyson, *S. S.*

Classen, *Alexander*. Theorie und Praxis der Massanalyse. Leipzig [1911]. pp. ix + 772.

Cohen, *Ernst*. Jacobus Henricus van't Hoff. Sein Leben und Wirken. Leipzig 1912. pp. xv + 638. ill.

— See Hoff, *Jacobus Henricus van't*.

Cohnheim, *Otto*. Chemie der Eiweisskörper. 3rd edition. Braunschweig 1911. pp. xii + 388.

Corridi, *Lamberto*. Contributo allo studio dei prodotti di assorbimento dell' Iodio. (From the *Arch. Farm. speriment. Sci.*, 1911, 12.)

Coste, *John Henry*. The calorific power of gas. A treatise on calorific standards and calorimetry. London 1911. pp. xvi + 310. ill.

Couper, *Archibald Scott*. Ueber eine neue chemische Theorie. Edited by *Richard Anschütz*. (Ostwald's *Klassiker*, No. 183.) Leipzig 1911. pp. 40.

Cross, *Charles Frederick*. Lectures on cellulose. pp. 52. London 1912.

Dakin, *Henry Drysdale*. Oxidations and reductions in the animal body. London 1912. pp. viii + 135.

Dale, *Henry Hallett*. See Bargér, *George*.

Davis, *William Alfred*. See Allen, *Alfred Henry*.

Deeley, *R. Mountford*. See Archbutt, *Leonard*.

Diamare, *Vincenzo*. Die Biologie des Eies, als eine chemisch-anatomische Koordination. (From the *Anat. Anzeiger*, 1911, 40.)

— Sur le diabète pancréatique chez les hétérothermes. (From the *Arch. ital. biol.*, 55.)

Dudley, *Charles Benjamin*. See American Society for Testing Materials.

Dyson, S. S., and Clarkson, S. S. Chemical works. Their design, erection, and equipment. London 1912. pp. xii+207. ill.

Egypt, Survey Department. Reports on the work of the Laboratories in 1910, 1911. By **Alfred Lucas**. Cairo 1911, 1912. pp. 21, 26.

Ehrlich, Felix. Ueber die Bedeutung des Eiweiss-stoffwechsels für die Lebensvorgänge in der Pflanzenwelt. (Sammlung, Vol. XVII.) Stuttgart 1911.

Emde, Hermann. Spaltung des Phenäthyl-trimethyl-ammoniums. (From the *Apoth. Zeit.*, 1912, 27.)

Feilmann, Ernest. See **Molinari, Ettore**.

Felsen, Fedor. Türkischrot und seine Konkurrenten. Berlin 1912. pp. 128.

Ferguson, John. *Bibliotheca Chemica*: A catalogue of the alchemical, chemical, and pharmaceutical books in the collection of the late James Young of Kelly and Durris, Esq., LL.D., F.R.S., F.R.S.E. Glasgow 1906. 2 vols. pp. xxi+487, 598. Printed for private distribution. (*Recd.* 3/4/12.)

[**Field, Frederick.**] A chemical review. By a B. pp. 25. London 1863. (*Reference.*)

— The Chemical Alphabet. pp. 4. (*Reference.*)

Filippi, Eduardo. Contegno farmacologico di alcuni preparati mercuriali insolubili. I. (From the *Arch. Farm. Sper.*, 1911, 12.)

— Di alcune combinazioni e preparazioni iodiche usate comunemente in terapia. (From the *Arch. Farm. Sper.*, 1911, 12.)

— Proprietà farmacologiche dell' Adalina (Bromodietilacetil-carbammide). (From the *Arch. Farm. Sper.*, 1911, 12.)

Fraenkel, Sigmund. Die Arzneimittel-Synthese auf Grundlage der Beziehungen zwischen chemischem Aufbau und Wirkung. 3rd edition. Berlin 1912. pp. viii+823.

Fürth, Otto von. Probleme der physiologischen und pathologischen Chemie. I Band. Gewebchemie. Leipzig 1912. pp. xv+634.

Funk, Albert. See **Autenrieth, W.**

Garrett, A. E. The advance of photography. Its history and applications. London. ill. pp. xiii+382.

Geiger, H. See **Makower, W.**

Gestewitz, Kurt. Beiträge zur Kenntniss der Verhaltens von Kohlenoxydblut zu gewissen fallenden Agentien. (From the *Zeitsch. exp. Path. Ther.*, 1911, 9.)

Golding, John. Ropy milk. (From the *J. of the Board of Agric.*, 1912, 18.)

Graham, Thomas. Abhandlungen über Dialyse (Kolloide). Edited by **E. Jordis**. (Ostwald's *Klassiker*, No. 179.) Leipzig 1911. pp. 179.

Grüss, *J.* Biologie und Kapillaranalyse der Enzyme. Berlin 1912. pp. vi + 227.

Hainsworth, *Cecil H.* See Barelay, *William R.*

Hall, *William T.* See Treadwell, *Frederick Pearson.*

Hammarsten, *Olof.* A text book of physiological chemistry. Authorized translation from the . . . seventh German edition by *John A. Mandel.* 6th edition. New York 1911. pp. viii + 964.

Hampshire, *Charles H.* Volumetric analysis for students of pharmaceutical and general chemistry. London 1912. pp. vii + 104. ill.

Harris, *Frank.* Gravitation. London 1912. pp. xi + 107. ill.

Herapath, *William.* See Bristol and Clifton Hotwells.

Herty, *Charles H.* Per cent. tables for oil in cottonseed products. With method of analysis. pp. 50. North Carolina 1908.

Hoff, *J. H. van't* [and others]. Untersuchungen über die Bildungsverhältnisse der ozeanischen Salzablagerungen insbesondere des Stassfurter Salzlagers. Edited by *H. Precht* and *Ernst Cohen.* Leipzig 1912. pp. xx + 374. ill.

— See Cohen, *Ernst.*

— See Jorissen, *W. P.,* and Reicher, *L. Th.*

Holmberg, *Bror.* Ueber optisch aktive Dibrombernsteinsäuren. (From the *Svensk Kemisk Tidskrift*, 1911.)

Hooper, *David.* The composition of Indian yams. (From the *J. Proc. Asiatic Soc. Bengal*, 1911, 7.)

— Phosphorus in Indian foodstuffs. (From the *J. Proc. Asiatic Soc. Bengal*, 1911, 7.)

— Some Asiatic milk-products. (From the *J. Proc. Asiatic Soc. Bengal*, 1911, 7.)

Hoppe-Seyler, *Ernst Felix Immanuel* [Editor]. Medicinisch-chemische Untersuchungen. Aus dem Laboratorium für angewandte Chemie zu Tübingen. Berlin 1866–1871. (*Reference.*)

Houston, *Alexander Cruikshank.* See Metropolitan Water Board.

Hübner, *Julius.* Bleaching and dyeing of vegetable fibrous materials. London 1912. pp. xxiii + 434. ill.

India. Report on the progress of agriculture in India for 1910–11. pp. 85. Calcutta 1912.

Institute of Brewing. Collective index of the Journal, [*etc.*] 1887 to 1910. Compiled by *William H. Bird.* London 1911. pp. iv + 550. (*Reference.*)

Institute of Chemistry of Great Britain and Ireland. A list of official chemical appointments compiled, . . . by *Richard B. Pilcher,* 4th edition. London 1912. pp. 246.

International Institute of Agriculture. Bulletin of the Bureau of

Agricultural Intelligence and of Plant-diseases. Year I., etc. Rome 1911+. (*Reference.*)

Irvine, *James Colquhoun*. See St. Andrews, University of.

Jellinek, *Karl*. Das Hydrosulfit. Grundzüge der physikalischen Chemie des Hydrosulfits im Vergleich zu analogen Schwefelsauerstoffderivaten. (Sammlung, Vol. XVII., XVIII.) Stuttgart 1911, 1912.

Jordis, *E*. See Graham, *Thomas*.

Jorissen, *W. P.*, and Reicher, *L. Th.* J. H. van't Hoff's Amsterdamer Periode, 1877-1895. Helder 1912. pp. vi + 106.

Kappelmeier, *Paul*. Die Konstitutionserforschung der wichtigsten Opiumalkaloiden. (Sammlung, Vol. XVIII.) Stuttgart 1912.

Kinch, *Edward*. See Church, *Sir Arthur Herbert*.

Lange, *Otto*. Die Schwefelfarbstoffe, ihre Herstellung und Verwendung. Leipzig 1912. pp. xii + 497. ill.

Le Chatelier, *Henri Louis*. See Burgess, *G. K.*

Lieben, *Adolf*. Collected papers, 1854-1910. 2 vols. (*Reference.*)

Lucas, *Alfred*. Preservative materials used by the ancient Egyptians in embalming. Cairo 1911. pp. 59.

— See Egypt, *Survey Department*.

Lüning, *O*. See Beckurts, *H.*

Luzzatto, *R.*, and Satta, *G*. Interno al comportamento nell' organismo animale dell' orto-jodanisolo. (From the *Arch. Farm. Sper.*, 1911, 11.)

MacDonald, *George William*. Historical papers on modern explosives. With an introduction by *Sir Andrew Noble*. London 1912. pp. xi + 192.

MacEwan, *Peter*. Pharmaceutical Formulas . . . collected chiefly from *The Chemist and Druggist* and *The Chemists' and Druggists' Diaries*. 8th edition. London 1911. pp. xvi + 1040.

— The art of dispensing: a treatise on the methods and processes involved in compounding medical prescriptions. With dictionaries of abbreviations, [etc.]. 9th edition. London 1912. pp. viii + 584. ill.

M'Intosh, *William Carmichael*. See St. Andrews, University of.

Makower, *W.*, and Geiger, *H.* Practical measurements in radioactivity. London 1912. pp. ix + 151. ill.

Mameli, *Efisio*, and Patta, *Aldo*. Dell' acido para-iodiofenilarsinico e di alcuni suoi derivati. II. and III (From the *Arch. Farm. Sper.*, 1911, 11 and 12.)

Mandel, *John A.* See Hammarsten, *Olaf*.

Martin, *Geoffrey*. Triumphs and wonders of modern chemistry. London [1912]. pp. xvii + 358. ill.

— [and others]. Industrial and manufacturing chemistry. Organic. London [1912]. pp. xx + 726. ill.

Martindale, William Harrison, and Westcott, W. Wynn. The Extra Pharmacopoeia. 15th edition. London 1912. 2 vols. pp. xxxi+1114, viii+370. 21/- net.

Mastin, John. See **Pepper, John Henry.**

Maurantonio, Leonardo. L'arsenico nella scienza, nell' industria e negli avvelenamenti. Milano 1912. pp. xii+256. ill.

Mellor, Joseph William. Modern inorganic chemistry. London 1912. pp. xx+871. ill.

Merck, E. Prüfung der chemischen Reagenzien auf Reinheit. 2nd edition. Darmstadt 1912. pp. v+332.

Metropolitan Water Board. Seventh report on research work. By **Alexander Cruikshank Houston.** pp. 79. London 1911.

Meyer, Lothar. See **Seubert, Karl.**

Michelson, A. A. Light waves and their uses. Chicago [1903]. pp. vi+166. ill.

Miyake, K. Ueber die Nicht-Eiweiss-Stickstoff Bestandteile der Schösslinge von *Sasa paniculata*. (From the *J. Coll. Agric. Tohoku Imp. Univ.*, 1911, 4.)

— and **Tadokoro, T.** On the carbohydrates of the shoots of the *Sasa paniculata*. (From the *J. Coll. Agric. Tohoku Imp. Univ.* 1911, 4.)

Molinari, Ettore. Trattato di chimica organica generale e applicata all'industria. 2nd edition. Milano 1912. pp. xxiv.+1087. ill.

— Treatise on general and industrial inorganic chemistry. Translated by **Ernest Feilmann.** London 1912. pp. xvi+704. ill.

Müller, Gerhard. See **Autenreith, W.**

Neumann, Bernhard. Lehrbuch der chemischen Technologie und Metallurgie. Leipzig 1912. pp. xii+892. ill.

Nisbet, Harry. Theory of sizing. Manchester 1912. pp. xi+75. ill.

Noble, Sir Andrew. See **MacDonald, George William.**

Norman, Ragnar. See **Tauber, Ernst.**

Norton, Thomas H. Utilization of atmospheric nitrogen. (U.S. Dept. Commerce and Labor. Bureau of manufactures. Special Agents Series, No. 52.) Washington 1912. pp. 178. ill.

Ogilvie, James P. The determination of sucrose (cane sugar) in cane molasses by the double polarization method, using invertase and acid as hydrolysts. (From the *Int. Sugar J.*, 1912, 14.)

Ostwald's Klassiker. See **Couper, Archibald Scott, and Graham Thomas.**

Oshima, K., and Tadokoro, T. On the carbohydrate group in Yam Mucin. (From the *J. Coll. Agric. Tohoku Imp. Univ.*, 1911, 4.)

Ostwald, Wilhelm. Outlines of general chemistry. Translated by **W. W. Taylor.** 3rd edition. London 1912. pp. xvii+596.

Parry, Ernest John. Food and drugs. Vol. I. The analysis of food and drugs (chemical and microscopical). Vol. II. The Sale of Food and Drugs Acts, 1875-1907. London 1911. pp. viii+744. 181. ill.

Patta, Aldo, and Caccia, Piero. Sul tetraioduro di para-amino-fenilarsenico. (From the *Boll. Soc. Med.-hir. Pavia*, 1911.)

— See **Mameli, Efisio.**

Pepper, John Henry. The Boy's Playbook of Science. Rewritten by **John Mastin.** London [1912]. pp. ix+680. ill.

Pick, Ernst P. Biochemie der Antigene. Jena 1912. pp. viii+184.

Pick, Hans. See **Auerbach, Friedrich.**

Pilcher, Richard B. See **Institute of Chemistry.**

Plimmer, Robert Henry Aders. The chemical constitution of the proteins. Part I. Analysis. 2nd edition. London 1912. pp. xii+188.

Plotnikow, Johannes. Photochemische Versuchstechnik. Leipzig 1912. pp. xv+371. ill.

Polenske, Ed. Beiträge zum Nachweis der Benzoesäure in Nahrungs-und Genussmitteln. (From the *Arbeit. Kaiserl. Gesundheitsamte*, 1911, 38.)

Pollitzer, F. Die Berechnung chemischer Affinitäten nach dem Nernstschen Wärmetheorem. (Sammlung, Vol. XVII.) Stuttgart 1912.

Pope, Frank George. Modern research in organic chemistry. London 1912. pp. xii+324. ill.

Precht, H. See **Hoff, Jacobus Henricus van't.**

Prescriber, The. A monthly journal dealing with therapeutics, pharmacology and the newer remedies. Edited by **Thomas Stephenson.** Vols. II-V. Edinburgh 1908-1911.

Price, Thomas Slater. Per-acids and their salts. London 1912. pp. iv+123.

Reicher, L. Th. See **Jorrissen, W. P.**

Revis, Cecil. See **Bolton, Edwards Richards.**

Richards, Percy Andrew Ellis. Practical chemistry, including simple volumetric analysis and toxicology. 2nd edition. London 1912. pp. x+149.

Rossi, G. Su una nuova combinazione dell' exametilentetramina coll'acido ortoarsenico. (From the *Giorn. Farm. Chim.*, 1911, 60.)

Royal Society of London. The Record of the Royal Society of London. 3rd edition. London 1912. pp. viii+483. ill. (*Reference.*)

— The signatures in the first Journal-Book and the Charter-Book. Being a facsimile of the signatures of the Founders, Patrons, and Fellows of the Society from the year 1660 down to the present time, London 1912. pp. x+94+42. (*Reference.*)

Russell, *Edward John*. Soil conditions and plant growth. London 1912. pp. viii + 168.

Sadtler, *Samuel S.* See Allen, *Alfred Henry*.

Saint Andrews, University of. *Five hundredth Anniversary*. Memorial volume of scientific papers contributed by Members of the University. Edited by *William Carmichael M'Intosh*, *John Edward Aloysius Steggall*, and *James Colquhoun Irvine*. Edinburgh 1911. pp. xi + 354.

Schmidt, *Ernst*. Ueber die Polysulphydrate des Brucins. (From the *Apoth. Zeit.*, 1911.)

Schultz, *Gustav*. Farbstofftabellen. 5th edition of *Tabellarischen Uebersicht der künstlichen organischen Farbstoffe*. Lief. I., etc. Berlin 1911. (Reference.)

Schwalbe, *Carl G.* Die Chemie der Cellulose. Part II. Berlin 1911. pp. 273 to 666 + xii.

Seubert, *Karl*. Gedächtnisfeier bei der Enthüllung des Marmorbildnisses von Professor Dr. Lothar Meyer im grossen Hörsaal des neuen chemischen Universitäts Laboratoriums zu Tübingen am 3 August, 1911. Tübingen 1911. pp. 22.

Shaw, *Peter*. See Stahl, *George Ernest*.

Spencer, *James Frederick*. An experimental course of physical chemistry. Part II. Dynamical experiments. London 1911. pp. xvi + 256. ill.

Stahl, *George Ernest*. Philosophical principles of universal chemistry : or, the foundation of a scientific manner of inquiring into and preparing the natural and artificial bodies for the uses of life : Both in the way of experiment, and the larger way of business. Designed as a general introduction to the knowledge and practice of artificial philosophy : or, genuine chemistry in all its branches. Drawn from the *Collegium Jenense* of Dr. George Ernest Stahl by *Peter Shaw*. London 1730. pp. xxviii + 424 + [xxiv]. (Reference.)

Steggall, *John Edward Aloysius*. See St. Andrews, University of.

Steinmann, *A.* Étude critique sur les essais de platine. (From the *J. suisse chim. phys.*, 1911.)

Stephenson, *Thomas*. See Prescriber, *The*.

Süvern, *Karl*. Die künstliche Seide. Ihre Herstellung, Eigenschaften und Verwendung. 3rd edition. Berlin 1912. pp. xi + 631. ill.

Swanson, *C. O.* See Willard, *J. T.*

Tables annuelles de constantes et données numériques de chimie, de physique et de technologie. Publiées sous le patronage de l'Association internationale des Académies par le Comité international omné par le VII^e Congrès de Chimie appliquée (Londres, 2 Juin,

1909). Volume I. Année 1910. Paris 1912. (*Reference.*) pp. xxxix + 727.

Tadokoro, T. See Miyake, K.

— See Oshima, K.

Täuber, Ernst, and Norman, Ragnar. Die Derivate des Naphtalins. Berlin 1896. pp. viii + 219.

Taylor, W. W. See Ostwald, Wilhelm.

Thole, Ferdinand Bernard. A second year course of organic chemistry for technical institutes. The carbocyclic compounds. London 1912. pp. vi + 186.

— Qualitative organic analysis. London 1912. pp. x + 68. ill.

Thompson, M. de Kay. Applied electrochemistry. New York 1911. pp. xii + 329.

Thorpe, Sir Edward. A dictionary of applied chemistry. Vol. III. London 1912. pp. viii + 789. ill. (*Reference.*)

Tibbles, William. Foods: their origin, composition and manufacture. London 1912. pp. viii + 950.

Treadwell, Frederick Pearson. Analytical chemistry. Volume I. Qualitative analysis. Authorised translation from the German by William T. Hall. 2nd edition. New York 1911. pp. xi + 469. ill.

Urbain, Georges. Introduction a l'étude de la Spectrochimie. Paris 1911. pp. iii + 248. ill.

Villavecchia, Vittorio. Dizionario di merceologia e di chimica applicata. Vol. II. Milano [1912]. pp. [773]. (*Reference.*)

Virgili, Juan Fages y. Die indirekten Methoden der analytischen Chemie. (Sammlung, Vol. XVI.) Stuttgart 1911.

Waidner, C. W., and Burgess, George K. On the constancy of the sulphur boiling point. (From the *Bull. Bureau of Standards*, 1911, 7.)

Weigert, Fritz. Die chemischen Wirkungen des Lichts. (Sammlung, Vol. XVII.) Stuttgart 1911.

Westcott, W. Wynn. See Martindale, William Harrison.

Willard, J. T., and Swanson, C. O. The baking qualities of flour. (From the *Chem. Phys. Papers Kansas Acad. Sci.*, [1911].)

Zsigmondy, Richard. Kolloidchemie. Leipzig 1912. pp. xi + 294.

INDEX TO AUTHORS' NAMES.

- Abell, R. D., 145.
 Adams, E. B., 292.
 Anderson, D. G., 224.
 Angel, A., 46.
 Atkins, W. R. G., 141, 231, 233.
 Auld, S. J. M., 143.

 Backer, H. J., 65, 264.
 Bailey, C. W., 266.
 Bainbridge, J. S., 253.
 Baker, F., 165.
 Baker, H. B., 282.
 Baker, (Mrs.) M., 282.
 Balls, (Miss) K., 231.
 Baly, E. C. C., 196, 197, 312.
 Banerjee, M. N., 50, 102.
 Bauerjee, S. C., 102.
 Barger, G., 157.
 Barker, T. V., 253.
 Barnett, E. de B., 259.
 Barnett, R. T. F., 152.
 Bassett, H., jun., 48.
 Batey, J. P., 142.
 Bhaduri, K., 53.
 Bland, N., 49, 70, 131, 195, 217, 218.
 Bostock, C., 14.
 Bousfield, W. R., 72, 186.
 Bowden, R. C., 237.
 Brady, O. L., 285, 289.
 Branch, G. E. K., 293.
 Brazier, S. A., 127, 287.
 Bredt, J., 56.
 Briscoe, H. V. A., 219.
 Browning, H., jun., 285.
 Bulle, F., 288.

 Cain, J. C., 139, 277, 285.
 Carr, F. H., 124, 253.
 Carter, S. R., 292.
 Caw, W., 187.
 Chattaway, F. D., 158.
 Christopher, H., 93.
 Clarke, H. T., 218, 220.
 Clarke, (Miss) R., 236.
 Clayton, A., 6.
 Clewer, H. W. B., 13, 96, 265, 317.
 Clibbens, D. A., 291.
 Clough, G. W., 40.
 Cooper, O., 268.
 Cooper, W. F., 139.
 Cornish, (Miss) E. C. V., 237.
 Coulthard, A., 277.
 Coward, H. F., 268.
 Crabtree, J. I., 264.
 Crompton, H., 127, 193, 194.
 Crossley, A. W., 223, 332.
 Crowther, H. L., 315.
 Crymble, C. R., 162.
 Cumming, A. C., 225.
 Cunningham, (Miss) M., 38.

 Datta, R. L., 41, 258.
 Davidson, A., 43.
 Davies, H., 94, 103.
 Davies, S. H., 253.
 Dawson, H. M., 159.
 De, T., 151, 185.
 Derry, J. N., 278.
 Dey, B. B., 275.
 Dhar, N., 102, 151, 185, 292, 319.
 Dixon, A. E., 54, 265.
 Dobbie, J. J., 327.
 Dorée, C., 38, 196.
 Dunlop, J. G. M., 221, 230.
 Dunningham, A. C., 16.
 Dunstan, A. E., 14, 70, 269.
 Dutta, J. M., 106.

 Edwards, (Miss) M. G., 163.
 Evans, P. E., 164.
 Ewins, A. J., 38, 323, 329.

 Farrow, F. D., 19.
 Feilmann, M. E., 283.
 Fenton, H. J. H., 187.
 Ferns, J., 18, 263.
 Field, (Miss) E., 157.
 Findlay, A., 195.
 Firth, J. B., 101.
 Fletcher, J., 189, 319.
 Forster, M. O., 37, 46, 50, 219, 275, 318.
 Fox, J. J., 200, 327.
 Franchimont, A. P. N., 264.
 Francis, F. E., 291.
 Frankland, E. P., 224.
 Frankland, P. F., 19, 292.
 Freeborn, A., 71.
 Funk, C., 140.

Garner, W. E., 65.
 Garrod, R. E., 163, 164.
 Gauge, A. J. H., 827.
 Gibson, C. S., 108, 109, 126, 220.
 Glendinning, W. G., 254.
 Glover, W. H., 185, 186.
 Godden, W., 6.
 Graham, J. I., 108.
 Green, A. G., 136, 137, 233, 250, 251,
 252.
 Groves, C. R., 62.

Haas, P., 163.
 Harden, A., 235.
 Harding, V. J., 219.
 Hardman, R. T., 263.
 Hartley, E. G. J., 101.
 Hartley, (Sir) W. N., 109.
 Haworth, W. N., 236.
 Heilbron, I. M., 192, 256.
 Henderson, G. G., 187, 270, 314.
 Henderson, J. A. R., 256.
 Hewitt, J. T., 69, 140, 229, 230, 231.
 Heycock, C. T., 3.
 Hibbert, H., 15.
 Higgins, S. H., 130.
 Hilditch, T. P., 269, 276.
 Hill, T. H., 290.
 Hodgson, H. H., 222.
 Holden, T. H., 227.
 Hollely, W. F., 128.
 Hope, E., 16, 17, 93, 192.
 Hopwood, A., 261.
 Howard, H. A. H., 313.
 Hughes, E. C., 6.
 Hutchison, A. M., 62.
 Hynd, A., 54, 126, 319.

Irvine, J. O., 54, 126, 319.

James, D. I., 143.
 Jerusalem, G., 165.
 Jobling, E., 152.
 Jones, E. G., 4.
 Jones, (Miss) M., 221, 222.
 Jones, H. O., 129, 143, 163, 164, 221,
 229.
 Jowett, H. A., 268.

Kendall, J., 158, 255.
 Kenyon, J., 137.
 Kenner, J., 187, 277.
 Kenyon, J., 42.
 King, A. T., 236, 315.
 King, H., 328.
 Kipping, F. S., 243, 244, 245, 313.
 Knecht, E., 142.
 Krulla, R., 196.

Lambert, B., 197.
 Lamplough, F. E. E., 3.

Landan, A. L., 2.
 Langton, H., 14.
 Lankshear, F. R., 198.
 Lapworth, A., 18, 263, 264.
 Law, H. D., 98, 162.
 Levy, L. A., 91.
 Levy, S. I., 316.
 Lewcock, W., 69, 152.
 Lewis, E. A., 290.
 Lewis, W. C. M., 239, 288.
 Linch, F. W., 144, 230.
 Lister, J., 162.
 Lowry, T. M., 64, 65, 72, 185, 186.

McBain, J. W., 106, 237.
 Macbeth, A. K., 68, 71, 271.
 McClelland, N. P., 188, 233, 247.
 McCombie, H., 127, 238, 266, 287, 315,
 331.
 McDavid, J. W., 160.
 McKenzie, A., 40, 160, 326.
 McMillan, A., 101.
 Marle, E. R., 5.
 Martin, G., 326.
 Masson, I., 183.
 May, P., 5, 96, 329.
 Meldola, R., 128.
 Merriman, R. W., 246.
 Merton, T. R., 325.
 Mickethwait, (Miss) F. M. G., 19, 68,
 277, 325.
 Mills, (Mrs.) M., 242.
 Mills, W. H., 242, 243, 262.
 Montgomerie, H. H., 240.
 Moore, T. S., 126, 278.
 Morgan, G. T., 19, 68, 152, 199, 325,
 334.
 Morrell, R. S., 235.
 Moss, H. W., 199, 325.
 Müller, H., 291.
 Mussell, A. G., 70.
 Myers, J. E., 99, 101.

Neave, G. B., 53.
 Neogi, P., 41, 53.
 Neville, A., 130.
 Newman, S. H., 231.
 Nolan, T. J., 188, 276.
 Norman, G. M., 232.
 Normand, C. W. B., 225.
 Nuttall, W. H., 139.

Orton, K. J. P., 221, 222.
 O'Sullivan, H. H., 19.

Page, H. J., 38.
 Parkes, J. W., 238.
 Patterson, T. S., 8, 43, 101, 224, 240,
 324.
 Perkin, A. G., 94, 198, 328.

- Perkin, W. H., jun., 4, 7, 56, 153, 154, 160, 217.
 Perkins, W. H., 315.
 Philip, J. C., 226, 259.
 Pickard, R. H., 42, 137.
 Pickering, S. U., 142, 184.
 Pickles, S. S., 143, 192.
 Pope, F. G., 69, 200, 225, 230, 331.
 Pope, W. J., 49, 107, 108, 109, 126, 220, 275, 278.
 Power, F. B., 39, 285.
 Powis, F., 150.
 Preston, R. W. D., 229.
 Price, T. S., 159.
 Purvis, J. E., 157, 188, 233.
 Pyman, F. L., 47, 228, 267, 268.
- Rakshit, J. N., 41, 102.
 Ramsay, Sir W., 182, 183.
 Ratcliffe, W. H., 229.
 Rây, P. C., 41, 102, 151, 185, 258, 292, 319.
 Read, J., 49, 107, 240, 278.
 Reilly, J., 334.
 Remfry, F. G. P., 228.
 Renouf, (Miss) N., 223.
 Reynolds, W. C., 124.
 Rhead, T. F. E., 104, 105.
 Rice, F. O., 197, 312.
 Roberts, W. M., 4.
 Robertson, P. W., 219.
 Robinson, C. S., 129.
 Robinson, R., 4, 7, 16, 17, 153, 154, 160, 162, 217.
 Robison, R., 245.
 Rogerson, H., 39, 138.
 Roshdestwensky, A., 239.
 Ross, K., 162, 275.
 Rowe, F. M., 233, 251, 252.
 Ruhemann, S., 95, 224, 316.
- Salway, A. H., 125.
 Scarborough, H. A., 331.
 Schaeppi, J. H., 37, 219.
 Schotz, S. P., 314.
 Schwes, F., 239, 246, 294.
 Scott, (Miss) M. E., 217.
 Sell, W. J., 165, 234.
 Sen, R. N., 137.
 Senier, A., 236.
 Senter, G., 238, 293.
 Shen, B., 195.
 Shepherd, F. G., 236.
 Simonsen, J. L., 139.
 Smiles, S., 62, 93, 162, 188, 275, 276, 329.
 Smith, C., 152.
 Smith, H. E., 224.
 Smith, S., 332.
- Smith, T. A., 313.
 Smyth, (Miss), W. R., 194.
 Smythe, J. A., 242.
 Somervell, D. B., 278.
 Spinner, H., 46.
 Steinberg, D. B., 140.
 Stephen, H., 94, 103, 160.
 Stevenson, (Miss) E. F., 8.
 Stewart, A. W., 68, 71, 254.
 Stotesbury, C., 196.
 Sudborough, J. J., 5, 41, 93.
 Sutherland, (Miss) M. M. J., 270.
 Swinton, A. E., 158.
- Taylor, (Miss) C. M., 148.
 Taylor, H. S., 48, 314.
 Taylor, J., 54, 265.
 Taylor, R. L., 14.
 Thole, F. B., 3, 51, 70, 269, 286.
 Thomas, E. R., 188.
 Thomas, J., 108.
 Thompson, H. V., 146.
 Thorpe, J. F., 4, 49, 51, 56, 70, 131, 195, 217, 218.
 Tinkler, C. K., 161.
 Titherley, A. W., 6, 227, 293.
 Turner, (Miss) E. G., 277.
 Turner, (Miss) M. K., 5.
 Turner, T., 62.
 Turner, W. E. S., 234.
 Tutin, F., 13, 96, 265, 317.
 Twiss, D. F., 159.
 Tyrer, D., 128, 189, 319.
- Wade, J., 246.
 Walker, (Miss) M., 127.
 Wallace, T. A., 141, 231.
 Warburton, C. H., 268.
 Ward, T. J., 293.
 Watson, E. R., 106.
 Watson, W. H., 262.
 Weizmann, C., 94, 103, 160, 261.
 Werner, E. A., 141, 233, 240, 241, 257.
 Wheeler, R. V., 104, 105.
 Wilks, W. A. R., 187.
 Willett, (Miss) W. I., 230.
 Williams, H. E., 317.
 Williams, H. G., 327.
 Williams, T., 41.
 Wilson, F. J., 192.
 Wimmill, T. F., 93, 109, 275.
 Withers, J. C., 50.
 Wolff, S., 250.
 Wood, A. S., 225.
 Woodhead, A. E., 136.
 Wright, R., 71, 96.
- Young, C. R., 143.
 Young, W. J., 235

INDEX TO DISCUSSIONS.

Brady, O. L., 254.

Chapman, A. C., 183.

Dreaper, W. P., 64.

Dunstan, A. E., 3, 138.

Egerton, A. C. G., 63.

Feilmann, M. E., 65.

Frankland, P. F., 324.

Finnemore, H., 138.

Hewitt, J. T., 286.

Hodgkinson, W. R. E., 63.

Hollins, C., 39.

Landau, A. L., 2.

Levy, L. A., 92.

Masson, I., 183.

Morgan, G. T., 157.

Page, H. J., 39.

Patterson, T. S., 324.

Pickering, S. U., 184.

Ramsay, Sir W., 183.

Reynolds, J. E., 92.

Robertson, P. W., 184.

Robertson, R., 65.

Rogerson, H., 139.

Spencer, J. F., 39, 63.

Thole, F. B., 3, 287.

Tilden, Sir W., 37.

Travers, M., 183.

Turner, T., 64.

INDEX OF SUBJECTS.

- Absorption Spectra. See under Photochemistry.
- Acenaphthene, halogen derivatives of, 127.
chloro-, oxidation of, with chromic acid, 194.
- Acenaphthenequinone, chloro-, and its derivatives, 194.
- Acetic acid, density of, 72.
ethyl ester, purification and physical properties of, 246.
bromo-, sodium salt, formation of intermediate compounds in the hydrolysis of, 293.
chloro-, potassium salt, velocity of reaction between aliphatic amines and, 278.
cyano-, ethyl ester, condensation of, with acid chlorides, 103.
- Acetic acids, substituted, esterification constants of, 5.
- Acetic anhydride, preparation of pure, and its physical properties and reaction with bromine, 222.
hydrolysis of, 221, 259.
sodium oxide and water, equilibrium in the system, 16.
- Acetoacetic acid, ethyl ester, condensation of acid chlorides with, 103.
- Acetone, electrochemistry of solutions in, 239.
reaction of iodine and, 159.
- Acetone- α -quinolyldihydrazone, 155.
- Acetophenone, *p*-hydroxy-, nitration of, 331.
- Acetoxynaphthaxanthone, 107.
- C*-Acetyldimethyldihydroresorcin, action of hydroxylamine and of phenylhydrazine on, 223.
- Acetylene, *di*-iodo-, preparation of, and its reactions with organic sodio-derivatives, 146.
- C*-Acetyltrimethyldihydroresorcin, action of hydroxylamine and of phenylhydrazine on, 223.
- Acids, dissociation formula for, 158.
dibasic, action of Grignard reagents on esters of, 140.
organic, sodium salts, influence of, on the rate of hydrolysis by alkali, 288.
saturated and unsaturated, hydrolysis of esters of, 41.
- Acid chlorides, condensation of, with ethyl cyanoacetate, ethyl malonate and ethyl acetoacetate, 103.
- Aconitic acids, chemistry of the, 131, 195.
- Aconitine, constitution of, 289.
oxidation of, 253.
- Acyl chlorides, action of, on primary amides, 227.
- Acylaminoketones, isomeric change of halogen-substituted diacylanilines into, 46.
- Adipic acid, derivatives of, 94.
- Address to the Royal Society, 248.
- AFFINITY CHEMICAL:—
Residual affinity and chemical constitution, relation between, 220.
Velocity of hydrolysis, influence of sodium salts of organic acids on the, by alkali, 288.
Velocity of reaction, influence of neutral solvents on, 240.
- Alcohols, viscosity of mixtures of ethers and, 165.
racemic, resolution of, 42.
- Aldehydes, absorption spectra of, 233.
condensation of pentaerythritol with, 240.
unsaturated, electrolytic reduction of, 98.
- o*-Aldehydosuccinanilic acid, 155.
- Aldol bases, constitution and derivatives of, 163, 164.
- Alkyl haloids, rate of reaction of tertiary bases with, 229.
- Alkylammonium nitrites, 41.
- Alkylnitrosoamides, electrolytic reduction of, 65.

- 4-Alkyl-1:4-thiazans, 218.
- Alloys, behaviour of, when heated in a vacuum, 62.
- Allyl alcohol, properties of mixtures of water and, 141.
properties of mixtures of benzene, water, and, 231.
- Allylamine, action of, on *s*-dibromosuccinic acid, 224.
- Allylammonium nitrite, 258.
- Amides, primary, action of acyl chlorides on, 227.
action of benzotrichloride on, 227.
- Amines, ionisation and hydration constants of, 126.
viscosity of, 70.
action of sulphur on, 222.
aliphatic, velocity of reaction between potassium chloroacetate and, 278.
primary, secondary and tertiary, nitrites of, 41, 53.
- Ammonia, state of, in aqueous solution, 109.
ionisation and hydration constants of, 126.
- Ammonium base, investigation of the change of carbinol into, 161.
compounds, quaternary substituted, configuration of, 221.
dicyclic quaternary, study of, 230.
nitrite, vapour density of, 151.
salts, organic, molecular condition of, in bromoform, 234.
quaternary, influence of the constitution of tertiary bases on the rate of formation of, 188.
thiocyanate, dynamic isomerism of thiocarbamide and, 141, 233.
- Amylglucoside, α -amino-, 320.
- Amylylacetylacetoacetic acid, ethyl ester, 103.
- 4-*iso*Amyl-1:4-thiazan, 218.
- Anhydrobisbenzylsilicanediol, 245.
- Anhydrobisphenylethylsilicanediol, 245.
- Anhydrohydrastininemeconine, 18.
- Anhydropilosine, 267.
- Aniline, *m*-chloro-, effect of heat on a mixture of benzaldehydecyanohydrin and, 266.
p-chloro-, and *p*-bromo-, dibenzoyl derivatives, isomeric change of, 46.
o-nitro-, oxidation of, 251, 252.
- Aniline-black and allied compounds, 136, 250.
- β -Anilino- $\alpha\beta$ -diphenylethane, α -hydroxy-, formation of tetrahydro-oxazoles from, 315.
- Anilinophenylacetoneitrile, *m*-chloro-, 266.
- Anissynaldoxime, transformation of, 240.
- Annual General Meeting, 75.
- Antimony trichloride, compounds of, with diazonium chlorides, 96.
- Antimony organic compounds, 5, 19, 68, 96.
- m*-Antimonylaniline, 5.
- Antipyrine, 4-amino-, diazonium salts from, 334.
- Apigenin triethyl ether, 328.
- Arabinol, 14.
- Arsenic organic compounds, 68.
quaternary asymmetric, attempted resolution of, 93.
- Arylideneamines, 236.
- Association and viscosity, 51, 286.
- Atherosperma moschatum*, essential oil of the leaves of, 217.
- Atomic weights, report of the International Committee on, 214.
table of, 216.
tendency of, to approximate to integral and semi-integral values, 283.
- Atropurol, 138.
- Azine series, studies in the, 231.
- Azobenzene, 4:4'-dibromo- and 4:4'-dichloro-2-amino-, 232.
o-hydroxy-, derivatives of, 229.
- Azo-colouring matters of the triphenylmethane group, 137.
- Azo-compounds, amino-, 232.
- Azoimide, interaction of nitrous acid and, 257.
- Azoimides, benzenoid, containing multivalent iodine, 219.
- Bases, tertiary, influence of the constitution of, on the rate of formation of quaternary ammonium salts, 188.
rate of reaction of alkyl haloids with, 229.
- Becquerel memorial lecture, 247.
- Benzaldehydecyanohydrin, effect of heat on a mixture of, with *m*-chloroaniline and with *m*-toluidine, 266.
- Benzene, properties of mixtures of allyl alcohol, water, and, 231.
latent heat of, 319.
pyrogenic decomposition of, 152.
thiolazo-derivatives of, 200.
- Benzeneazophenylethylmercaptole, 200.
- Benzeneazophenylmethylmercaptole, and *p*-nitro-, 200.
- Benzfurazan. See Benzisooxadiazole.
- Benzidine, dinitro-derivatives, 277.
- Benzilhydrazoxime, 275.
- Benziminazole derivatives, 161.
- Benzoic acid, cholesteryl ester, action of bromine on, 196.

- Benzoic acids, substituted, esterification constants of, 5.
- Benzoic anhydride, *di-p*-chloro-, and *di-m*- and *-p*-iodo-, 292.
- Benzophenone, 5-bromo-*o*-amino-, and 5-chloro-*o*-amino-, benzoyl derivatives, 46.
- Benzotrichloride, action of, on primary amides, 227.
- Benzisooxadiazole oxides, 252.
- Benzoylalanine, resolution of, 126.
- Benzoylcitrullol, 318.
- Benzyl compounds of sulphur, oxidation of, 242.
- Benzylethylammonium nitrite, 258.
- Benzylethylsilicanediol, 245.
- Benzylglucoside, α -amino-, 320.
- C*-Benzylharmine and its hydrochloride, 153.
- Benzylidene-diamides, *N*-chloro- derivatives of, 158.
- Benzylideneharmine, and *p*-nitro-, 153.
- Benzylmethylammonium nitrite, 258.
- Benzylmethylnitrosoamine, 258.
- 4-Benzyl-1 : 4-thiazan, 218.
- Berberilene, 161.
- Beta vulgaris*, constituents of the fat of, 130.
- $\alpha\beta$ - and $\alpha\gamma$ -Bistriazochloropropanes, 50.
- $\alpha\beta$ -Bistriazopropyl alcohol, 50.
- $\alpha\gamma$ -Bistriazoisopropyl alcohol, 50.
- $\alpha\gamma$ -Bistriazopropylene, 50.
- Bleaching-powder, action of dilute acids on, 14.
- Bleaching-process, investigation of the, 130.
- Boiling-point apparatus, Beckmann, modification of the, 142.
- Boisbaudran, M. Lecoq de, reference to decease of, 151.
- Bornylene, pure, preparation of, 187.
- Bornylenehydroxamic acid, 57.
- Bosanquet, Mr. R. H. M., reference to decease of, 248.
- Brass, behaviour of, on heating in hydrogen, 290.
- Brazilin, experiments on the synthesis of, 7.
- Bromoacetyl haloids, condensation of, with glucosamine, 261.
- Bromoform as a cryoscopic solvent, 234.
- Butanetetra-carboxylic acid, dihydroxy-, ethyl ester, 147.
- sec*-Butylamine, resolution of, 220.
- iso*Butylammonium nitrite, 41.
- Cadmium, boiling point of, 3.
- Cacaupina bonducella*, constituents of the seeds of, 53.
- Calcium nitrate, equilibrium of, with water and nitric acid, 48.
- Camphene, constitution of, 236.
- series, studies in the, 46, 313.
- Camphenic acid, structure of, 236.
- Camphor, *iso*amino-, orientation of, 313.
- β -hydroxy- and its semicarbazone, 313.
- Camphorcarboxylamide, crystallography of, 185.
- isomeric change in, 186.
- Camphorcarboxypiperidide, crystallography of, 185.
- isomeric change in, 186.
- d*-Camphor- β -sulphonic acid, optically active salts and derivatives of, 108.
- Carbamide derivatives, action of sodium hypobromite on, 144.
- Carbethoxy- γ -methyloaconitic acid, ethyl ester, 131.
- Carbinol, investigation of the change of, into ammonium base, 161.
- Carbon, asymmetric, model of an atom of, 65.
- combustion of, 105.
- velocity of reduction of carbon dioxide by, 104.
- tetrachloride, properties of mixtures of ethyl alcohol, water, and, 290.
- dioxide, solubility of, 195.
- velocity of reduction of, by carbon, 104.
- Carbonic acid, rate of neutralisation of, 106.
- Carbon disulphide as solvent in determining refraction constant, 239.
- Carbonyl chloride, condensation of, with α -keto- β -anilino- α -phenylethane, 331.
- Carbostyryl- β -acetic acid, and its derivatives, 155.
- Carvacrol, synthesis of a menthadiene from, 314.
- Cedrela toona*, colouring matters of the flowers of, 198.
- Cellulose, action of ozone on, 38.
- Certificates of candidates for election, 22, 113, 168, 297.
- Chemical constitution and residual affinity, relation between, 220.
- dependence of rotatory power on, 42, 137.
- relation between rotatory power and, amongst derivatives of tetrahydroquinaldine, 275.
- relation between viscosity and, 269.
- reactivity, relation between absorption spectra and, 197, 312.
- Chinese wood oil, studies of, 235.
- Chloral, action of, on ethyl tartrate and on ethyl malate, 101.
- Chlorine :—
- Hypochlorites, estimation of, 327.
- Chloroform, latent heat of, 319.
- Cholalic acid, blue compound of iodine with, 157.

Cholesteryl benzoate, action of bromine on, 196.
 Chrysarobin, commercial, constituents of, 13.
 Citraconic acid, ethyl ester, condensation of, with ethyl sodiomalonate, 93.
 Citrullol, formula of, 318.
Cluytia similis, constituents of, 265.
 Cluytanol and its triacetyl and tribenzoyl derivatives, 265
 formula of, 318.
 Cluytiasterol, 265.
 Cluytinic acid and its cluytyl ester, 265.
 Cluytyl alcohol 265.
 Cobalt organic compounds, 264.
 hydrogen ferrocyanide, 317.
 Cocoa, essential oil of, 253.
 Colloids, influence of, on the solubility of gases in water, 195.
 Committees, appointment of, by Council, 90.
 Conductivity water. See Water.
 Coniine methonitrite, 53.
 Coniinium nitrite, 53.
 Co-ordination, 253.
 Copper, catalytic action of, 162.
 catalytic action of, on terpene alcohols, 53.
 salts, colour intensity of, 184.
 sulphate, action of sodium hyposulphite on, 191.
 Cupric organic compounds, alkaline, 142.
 hydrogen ferrocyanide, 317.
 sodium hydrogen ferrocyanide, 317.
 Cotarnine, preparation of hydrastinine from, 228.
 Coumarin, 3-amino-, and its derivatives, 230.
 Coumarins, nitrothio-, preparation of, 6.
 Council, announcement of proposed changes in officers and, 36.
 report of, 75.
 Crystallography, chemical, studies in, 253.
 Cupric compounds. See under Copper.
 Cyanic acid, decomposition of, 225.
 Cytisine, constitution of, 329.
 α - and β -Cytisolidines, synthesis of, 329.
 Damascenine, constitution and synthesis of, 38.
 Dehydromodinanthranol methyl ether, 14.
 Desyl-*s*-diphenylcarbamide, 287.
 Diacenaphthylidenedione, dichloro-, 195.
 $\alpha\delta$ -Diacetoxyladipic acid, ethyl ester, 94.
 $\alpha\delta$ -Diacetoxyl- β -methyladipic acid, ethyl ester, 95.

Diacetylhydrazoxime, 275.
 Diacylanilides, halogen-substituted, isomeric change of, into acylamino-ketones, 46.
 Diallylaminosuccinic acid and its derivatives, 224.
 Diazoamino-compounds, 232.
 Diazoamino-*p*-toluene, 3 : 3'-dibromo-, 232.
 o -Diazoimines, constitution of, 325.
 Diazonium salts, non-aromatic, 334.
 chlorides, compounds of antimony chloride with, 96.
 Dibenzocycloheptadienecarboxylic acid, and its methyl ester, 187.
 Dibenzocycloheptadienedicarboxylic acid, 187.
 Dibenzocycloheptadienone and its derivatives, 277.
 Dibenzocyclooctadienetetracarboxylic acid, tetraethyl ester, 187.
 Dibenzoyldi-*m*-chloroanilino stilbene, 266.
 Dibenzoyliodomethane, 145.
 Dibenzoylmethane, tautomeric forms of, and derivatives of, 145.
 $\alpha\alpha$ -Dibenzoyl- β -phenylethane, 145.
 4 : 6-Dibenzoylisophthalic acid, 242.
 β -Dibenzoylpropionic acid, ethyl ester, 145.
 Dibenzoyltartaric acid, methyl ester, halogen derivatives of, 292.
 2 : 5-Dibenzoyltetraphthalic acid, 242.
 Dibenzyl-diethylstannane, 314.
 Dibenzylethylpropylstannane, 314.
 Dibenzylsilicanediol and its anhydro-derivative, 245.
 Dibenzyl-silicols and -silicones, 326.
 Dibenzylstannic salts, 314.
 Di-*trichloro*acetyl tartaric acid, preparation and temperature-rotation curves of esters of, 43.
 Diethylammonium nitrite, 41.
 Dihydrodinaphthanthracene, 243.
 Dihydro-oxazoles, preparation of, 238.
 Dihydroresorcinols, acyl derivatives of the, 223.
 1 : 2-Diketohydrindene, preparation of, 4.
 3 : 6-Diketo-1 : 2 : 3 : 6-tetrahydro-1 : 2 : 4 : 5-tetrazine, 144.
 d -Dimethoxysuccinanilic acid, 143.
 d -Dimethoxysuccinanilide, 143.
 d -Dimethoxysuccinic acid, optically active derivatives of, 143.
 $\alpha\beta$ -Dimethyladipic acid, β -hydroxy-, 219.
 Dimethyl aminomethylglucoside, 55.
 Dimethyldihydroresorcinol, bromoxyl-enols from, 332.
 2 : 2'-Dimethyldiphenyl (2 : 2'-ditolyl), formation of rings from, 187.

- 1 : 3 - Dimethyl - Δ^3 - cyclohexen - 5 - one, hydroxymethylene derivative, 316.
 α - and β -2 : 5-Dimethylpiperazines, absence of optical activity in the, 278.
 3 : 5-Dimethylpyrazole, 4-amino-, diazonium salts from, 334.
 Dimethyltetrahydroquinolines, synthesis of, 328, 329.
 2 : 4 - Dimethyltetrahydroquinolines, stereoisomeric, 108.
 Dinaphthanthracene derivatives, synthesis of, 242.
 Dinaphthanthradiquinone, 242.
 Dinaphthanthraquinone, 243.
 Dinaphthanthrone, 243.
 Dinaphthyldicarboxylic acid, *hexahydroxy*-. See *isopurpurogallone*.
 Diphenyl, *dinitro*-, 278.
 Diphenyl series, studies in the, 277, 285.
 Diphenylamine *o*-sulphoxides, intramolecular rearrangements of, 276.
 Diphenyl-2-carboxylic acid, 2'-hydroxy-, lactone of, 327.
 1 : 5-Diphenyl-3-*m*-chlorophenylglyoxaline, 266.
 3 : 5-Diphenyl-2 : 3-dihydro-2-oxazolone, 331.
 Diphenyldiphthalamic acids, 285.
 Diphenylene and its derivatives, 327.
 Diphenylhydroxystibine, *di-m*-amino-, and its hydrochloride, 20.
 Diphenyliodinium bromide, chloride, and iodide, perhalides of, 37.
 Diphenylsilicanediol, preparation and properties of, 243.
 condensation products of, 244.
 Diphenyl-silicols and -silicones, 326.
 Diphenyl-2 : 3 : 2' : 3'-tetracarboxylic acid, and its methyl ether, 277.
N-Diphenylisothiohydantoin, 54.
 $\alpha\delta$ -Diphthalaminoadipic acid, 95.
 $\alpha\delta$ -Diphthalaminoadipic acid, ethyl ester, 95.
 Dipropylammonium nitrite, 41.
 Disalicylidene - *m* - phenylenediamine, 237.
 Dithio-*o*-toluidine, and its derivatives, 223.
 Ditolyl. See Dimethyldiphenyl.
 Divers, Dr. E., reference to decease of, 90.
 Durylic acid, preparation of, 243.

β -Elaeostearic acid, 235.

Election of fellows, 36, 124, 182, 312.
 of honorary and foreign members, 45.

ELECTROCHEMISTRY :—

Electrochemistry of solutions in acetone, 239.

ELECTROCHEMISTRY :—

- Cells, concentration, with electrodes reversible to hydrions, 263.
 Electrolytes, strong, problem of, 255.
 Electrolytic reduction, 98, 162.
 Electromotive forces in alcohol, 263.
 Epiborneol, 57.
 Epicamphor, amino-, and bromo-, 57.
isonitroso-, 47.
 Epicamphorcarboxylic acid, and bromo-, 57.
 Ergot, yellow colouring-matter from, 71.
*iso*Erucic acid, 68.
 Eseroline, and its salts, 125.
 Esterification constants of substituted acetic and benzoic acids, 5.
 Esters, sulphonic, preparation and properties of, 263.
 Ethers, viscosity of mixtures of alcohols and, 165.
 Ethoxyacetylacetoacetic acid, ethyl ester, 103.
 Ethoxyacetylmalonic acid, ethyl ester, 103.
 Ethyl alcohol, properties of mixtures of carbon tetrachloride, water, and, 290.
 Ethylene oxide, action of, on hydrazine hydrate, 259.
 Ethylglucoside, α -amino-, 320.
 4(or 5)-Ethylglyoxaline, β -amino-, 48.
 α -Ethyl- β -glyoxaline-4(or 5)-propionic acid, β -hydroxy-, lactone, 47.
 Ethylhydrazine, β -hydroxy-, and its compound with formaldehyde, and *di*- β -hydroxy-, 259.
 Ethylpiperidine, β -chloro-, action of heat on, 230.
 Ethylpropylstannic chloride, 314.
 4-Ethyl-1 : 4-thiazan, 218.
 Euonymol, 138.
Euonymus atropurpureus, chemical examination of the bark of, 138.
 Euonysterol, 138.

Fatty compounds, absorption spectra of, 233.

refractivity of sulphur in, 159.

Ferricyanides, alkylation of, 101.

Ferrocyanides, alkylation of, 101.
 hydrogen, 317.

Flavone group, ethylation in the, 328.

Fluorescence, theory of, 196.

Baly and Krulla's hypothesis of, 271.

Formamidine disulphide, and its salts, properties of, 240.

action of nitrous acid on, 241.

Furan- β -carboxylic acid, 138.

Furan-2 : 5-dialdehyde and its derivatives, 139.

- Gas, electrolytic, ignition of, by the electric discharge, 268.
- Gases, influence of colloids on the solubility of, in water, 195.
- Glucosamine, condensation of bromo-acyl haloids with, 261.
- d*-Glucosamine, conversion of, into *d*-glucose, 54, 126.
- aminoglucosides derived from, 319.
- d*-Glucose, conversion of *d*-glucosamine into, 54, 126.
- Glucosides, amino-, derived from *d*-glucosamine, 319.
- Glutaconic acid, addition of hydrocyanic acid to derivatives of, 192.
- Glutaconic acids, chemistry of the, 49, 51, 56, 70, 217, 218.
- Glycerol, and its α -monochlorohydrin, aryl ethers of, 5.
- Glycide aryl ethers, 5.
- Glycogen, preparation of, from yeast, 235.
- Glycols, optically active, from the phenyl-lactic acids, 326.
- Glycollaldehyde, bimolecular, 247.
- Glyoxaline derivatives, synthesis of 47.
- 4(or 5)-Glyoxalineformaldehyde, 48.
- α -4(or 5)-Glyoxalinemethyl- α -cyano- β -ethylsuccinic acid, ethyl ester, 48.
- α -4(or 5)-Glyoxalinemethyl- β -ethylsuccinic acid and its ethyl ester, 48.
- 4(or 5)-Glyoxalinemethyl- γ -phenoxy-ethylmalonic acid, ethyl ester, 47.
- β -Gnoscopine, synthesis of, 16.
- Grignard reagents, action of, on esters of dibasic acids, 140.
- quantitative estimation of hydroxy-, amino-, and imino-derivatives of organic compounds by means of the, 15.
- Hæmatoxylin, experiments on the synthesis of, 7.
- Halogen derivatives and refraction constant, 246.
- Halogens, reactivity of, in organic compounds, 293.
- action of, on silver salts, 225, 314.
- Harmaline, 217.
- iso*Harmar, synthesis of, and its salts, 154.
- Harmine, constitution of, 153, 217.
- apo*Harmine, constitution of, 154.
- Heat of vaporisation. See under Thermchemistry.
- Helicin, α -amino-, 320.
- Hippuric acid, detection of, and α -hydroxy-, preparation of, 163.
- Homöonysterol, 138.
- Homologous series, viscosity of, 269.
- Homotaraxterol, 285.
- dl*- β -(or α -)Hydrastine, amino-, and nitro-, 17.
- Hydrastinine, preparation of, from cotarnine, 228.
- Hydrazine hydrate, action of ethylene oxide on, 259.
- Hydrolysis, rate of. See under Affinity.
- Hydrazino- β -gnoscopine, 17.
- Hydrazino-*dl*- β -(or α -)hydrastine, 18.
- Hydrindamines, hydroxy-, externally-compensated and optically active, 107.
- Hydrindones, hydroxymethylene derivatives of, 316.
- Hydrogen, solubility of, 195.
- ion, velocity of the, 158.
- Hydroxy-acids, racemisation of, by heat, 143.
- aliphatic, 187.
- Hypochlorites. See under Chlorine.
- Imino-compounds, formation and reactions of, 4.
- 4 : 5-Indenopyrazole-3-carboxylic acid, ethyl ester, and its 1-phenyl derivative, 224.
- Inositol and its derivatives and isomerides, 291.
- International association of Chemical societies, council and committees of, 86.
- proceedings of, 201.
- Iodine, reaction of acetone and, 159.
- interaction of thiocarbamide and, 240.
- blue compounds of, with starch, saponarin and cholic acid, 157.
- Ipuranol; formula of, 317.
- Iron, rusting of, 197.
- Isomerides, geometrical, viscosity of, 51.
- Isomerism, new form of, 277.
- dynamic, studies of, 185, 186.
- of ammonium thiocyanate and thiocarbamide, 141.
- influence of salts on the, 233.
- position, and optical activity, 292.
- Isomorphism, 253.
- Itaconic acid, addition of hydrocyanic acid to derivatives of, 192.
- Jones, Dr. H. O., reference to decease of, 248
- α -Keto- β -anilino- $\alpha\beta$ -diphenylethane, condensation of, with ethyl chlorocarbonate and thionyl chloride, 238.
- condensation of, with phenylcarbimide and with phenylthiocarbimide, 287.

- α -Keto- β -anilino- α -phenylethane, condensation of, with carbonyl chloride, phenylcarbimide and phenylthiocarbimide, 331.
- α -Keto- β -*m*-chloroanilino- $\alpha\beta$ -diphenylethane, 266.
- Ketones, absorption spectra of, 233.
aliphatic, conditions of isodynamic change in, 159.
cyclic, studies on, 224, 316.
unsaturated, electrolytic reduction of, 93.
- Ketonic acids, formation and hydrolysis of esters of, 93.
- Lauric acid, sodium salt, conductivity curve of, 237.
- Lead thiosulphate, precipitation of, 315.
- Lecture experiments, time-reactions suitable for, 254.
- Liquids, mixed, latent heats of vaporisation of, 123.
- Longstaff medal, presentation of, to Dr. H. Brereton Baker, 88.
- Luteolin tetraethyl ether, 328.
- Magnetic rotation. See Photochemistry.
- Malic acid, action of chloral on, 101.
- Mallet, Prof. J. W., reference to decease of, 281.
- Malonic acid, ethyl ester, condensation of acid chlorides with, 103.
sodium derivative, condensation of, with ethyl citraconate, 93.
dithio-, salts of, 129.
- Manganese trioxide, 198.
Permanganates, absorption spectra of, 109.
- Manganese hydrogen ferrocyanide, 317.
- Memorial lecture, Becquerel, 247.
- Menthadiene, synthesis of *n*, from carvacrol, 314.
- Mercurialkylammonium chlorides, 292.
nitrites, 41, 185.
- Mercurialkylarylammonium chlorides, 292.
nitrites, 41, 185.
- Mercury, boiling point of, 3
Mercuric nitrate, molecular conductivity of, 102.
- Metals, wet oxidation of, 197.
- Methoxide, sodium, action of, on 2:3:4:5-tetrachloropyridine, 165, 234.
- 3-Methoxybenzylidene-*p*-xylylidine, 2-hydroxy-, 237.
- 7-Methoxychromanone and its semicarbazone, 7.
- 8-Methoxy-2-methyltetrahydroisoquinoline, 6-, and 7-hydroxy-, 228.
- m*-Methoxy- β -phenoxypropionic acid, 7.
- 4-Methoxypropiofenone, ω -chloro-2-hydroxy-, 8.
- l*-Methoxysuccinic acid, optically active derivatives of, 143.
- β -Methyladipic acid, $\alpha\delta$ -dibromo- and its methyl ester, 95.
- Methyl aminomethylglucoside, 55.
- 2-Methylene-1-hydrindone, hydroxy-, 316.
- d*- and *l*-Methylethylphenacylthetine salts, rotatory power of, 148.
- Methylfurfuraldehyde, and ω -hydroxy-, β -naphthylamine derivatives, 139.
- Methylglucoside, amino-, hydrochloride, 54.
- 1-Methylcyclopentan-3-one, hydroxymethylene derivative, 316.
- Methylphosphinic acid, hydroxy-, and its homologues, 38.
- 2-Methyltetrahydroisoquinoline, 6-, and 7-hydroxy-, 228.
- 4-Methyl-1:4-thiazan, 218.
- β -Methyltricarballic acid, synthesis of, 93.
- Mixtures, binary, magnetic rotation of, 294.
- Molecular compounds, existence of, in solution, 14.
- Molecules, possible limitation of the magnitude of, 193.
- Morphineglucoside, α -amino-, 320.
- Myristic acid, sodium salt, conductivity curve of, 237.
- Naphthalene derivatives, absorption spectra of, 157.
- Naphthalene, α -bromo-, properties of, 264.
- Naphthalenecarboxylic acid, trihydroxy-. See Purpurogallone.
- β -Naphthalenediazoamino-*p*-chlorobenzene, 232.
- β -Naphthalenediazoamino-*m*-toluene, 232.
- β -Naphthasulphonium-quinone, reactions of, 93.
- Naphthathioxonium, salts of, 276.
- Naphthaxanthone, hydroxy-, and 3:4-dihydroxy-, and acetyl derivative of the latter, 107.
- β -Naphthol, sulphides of, 162.
action of bromine on, 188.
- iso- β -Naphthol sulphide, dehydration of, 275.
- isoNarcotine, constitution of, 4.
- Natin, 53.
- Neon, formation of, as a product of radioactive change, 182.
- Nepal camphor tree, essential oil of, 192.

- Nickel hydrogen ferrocyanide, 317.
 Nickelodithio-oxalic acid, 129.
 Nitrilotriacetic acid, menthyl ester, 19.
 Nitrites, molecular conductivity and ionisation of, 319.
 Nitroamides, aromatic, absorption spectra of, 152.
o-Nitroamines, quinonoid salts of, and their conversion into oxadiazole oxides, 252.
 Nitroamines, primary aliphatic, absorption spectra of cobalto-derivatives of, 264.
 aromatic, absorption spectra of, 152.
 Nitro-compounds, absorption spectra of, 230.
 Nitrogen, atmospheric, oxidation of, in presence of ozone, 64.
 compounds, formulation of, 126.
 asymmetric quinquivalent, 49.
 Nitrogen *tri*- and *tetr*-oxide, change in boiling points of, on drying, 282.
 Nitric acid, equilibrium of, with calcium nitrate and water, 48.
 Nitrates, absorption spectra of, 109.
 Nitrous acid, interaction of azoimide and, 257.
 Nitrohydrazo-compounds, alkaline condensations of, 233, 251.
 Nor-atropine, 124.
 Norisoharman, chloro-, and hydroxy-, 155.
 Norharmincarboxylic acid, 154.
 Nor-hyoscyamine, 124.
- Optical activity, relation of position-isomerism to, 292.
 absence of, in the α - and β -2:5-dimethylpiperazines, 278.
 Optically active compounds, relation between temperature and rotation of, 324.
 influence of solvents on the rotation of, 8, 224.
- Organic compounds, reactivity of the halogens in, 293.
 aromatic, absorption spectra of, 188.
 quantitative estimation of hydroxy-, amino- and imino-derivatives of, by Grignard reagents, 15.
- Oxadiazole oxides, 252.
 Oxalylbismethylnitrosoamide, 65.
 Oxasulph nazoles, preparation of, 238.
 Oxazole derivatives, 162.
 Oxonitin, 253.
 Oxydases, action of, on tyrosine derivatives, 140.
- 3-Oxy-(1)-thionaphthen, syntheses of, 62.
- Ozone, action of, on cellulose, 38.
 Palladiodithio-oxalic acid, 129.
 Palmitic acid, sodium salt, viscosity of aqueous solutions of, 19.
 Pattinson, Mr. J., reference to decease of, 90.
 Pentaerythritol, condensation of, with aldehydes, 240.
*iso*Pentane $\beta\delta$ -dicarboxylic acid, $\gamma\delta$ -dicyano-, ethyl ester, 193.
 Permanganates. See under Manganese.
 Phenol, bromination of, 225.
 2:4-, and 2:6-dibromo-, and their derivatives, 225.
 p-iodo-, chlorination of, 127.
 Phenols, migration of the para-halogen atom in, 219.
 Phenolphthalein, use of, as an indicator, 106.
 Phenoxacetylacetoacetic acid, ethyl ester, 103.
 Phenoxacetylcyanooacetic acid, ethyl ester, 103.
 Phenylazoimides, iodo-, and their derivatives, 219.
 2-Phenyl-1:3-benzoxazine-4-one, 6-chloro-, action of ammonia on, 6.
 Phenylbenzylsilicanediol, 245.
 Phenylcarbimide, condensation of α -keto- β -anilino- $\alpha\beta$ -diphenylethane with, 287.
 and phenylthiocarbimide, condensation of, with α -keto- β -anilino- α -phenylethane, 331.
 Phenylethylsilicanediol, 245.
 Phenyl 2'-hydroxynaphthyl ketone, 2:4-dihydroxy-, 107.
 Phenyl 2'-hydroxystyryl ketone, 2:4-dihydroxy-, and 2:3:4-trihydroxy-, 106.
 6-Phenyl-2:3-indeno-4-pyrone, 225.
 Phenyl-lactic acids, optically active glycols from, 326.
 Phenylmethylphosphinic acid, alkaloidal salts of, 109.
 Phenyl β -phenylethyl ketone, 2:3:4-trihydroxy-, 106.
 α -Phenylpropionic acid, α -amino, optically active forms of, 40.
 Phenylstibinic acid, *m*-amino-, and its sodium salt and chloride, 5.
 Phenyl styryl ketone, derivatives of, 145.
 semicarbazones of, 192.
 2:3:4-trihydroxy-, 106.
 2-Phenyl-1:4:5:6-tetrahydropyrimidine, 293.
 Phenylthiocarbimide, condensation of α -keto- β -anilino- $\alpha\beta$ -diphenylethane with, 287.
 Phenyl-*p*-tolylbenzylmethylphosphonium compounds, 108.

Phenyl-*p*-tolylmethylallylphosphonium compounds, 108.

Phosphonium derivatives, 108.

Phosphorus, action of potassium hydroxide solution and, 50.

PHOTOCHEMISTRY:—

Light, absorption of, variation in, produced by a solvent, 312.

Absorptive power, effect of unsaturated centres on, 71.

Photo-kinetics of sodium hypochlorite solutions, 288.

Photophosphorescence of inorganic solid solutions, 2.

Rotatory power, dependence of, on chemical constitution, 42, 137.
relation between constitution and, amongst derivatives of tetrahydroquinoline, 275.

Rotation, influence of solvents on the, of optically active compounds, 8.

Magnetic rotation of binary mixtures, 294.

Refraction and dispersion of triazocompounds, 226.

Refraction constant, and halogen derivatives, 246.
carbon disulphide as solvent in determination of, 239.

Spectra, absorption, and chemical reactivity, 197, 312.

photography of, 325.

of aliphatic substances, 233.

of naphthalene derivatives, 157.

of nitrates, 109.

of aromatic nitroamines and nitroamides, 152.

of the cobalto-derivatives of nitroamines, 264.

of nitro-compounds, 230.

of aromatic organic compounds, 188.

of permanganates, 109.

Phototropy, studies in, 236.

Phthalic acid, 3-iodo-, methyl ester, 277.

3-nitro-, 327.

Phthalide, tetrachloro-, chlorination of, 262.

Phthaliminoacetoacetic acid, ethyl ester, 104.

Phthaliminoacetyl bromomalonic acid, ethyl ester, 104.

Phthaliminoacetyl chloromalonic acid, ethyl ester, 104.

Phthaliminoacetyl malonic acid, ethyl ester, 103.

Phthalimino-*p*-methoxybenzylmalonic acid, ethyl ester, 160.

Phthaliminopiperonylmalonic acid, ethyl ester, 160.

β -Phthaliminopropionic acid, and its amyl ester, 104.

β -Phthaliminopropionylmalonic acid, ethyl ester, 104.

Phthalyl chloride, tetrachloro-, formation of, 262.

Physostigmine, constitution of, 125.

Picramic acid, methylation of, 128.

*iso*Picramic acid, methylation of, 128.

Pilocarpine, occurrence of, in the leaves of *pilocarpus racemosus*, 268.

Pilocarpus microphyllus, new alkaloid from, 267.

Pilocarpus racemosus, alkaloids of, 268.

Pilosine, 267.

Pilosinine, 267.

Pinene, oxidation of, with hydrogen peroxide, 270.

Piperazinium, nitroso-, nitrite, 102.

Piperidine ethonitrite, 53.

Platinocyanides, studies on, 91.

Potassium, boiling point of, 3.

cyanate, action of halogens on, 225.

hydroxide, action of phosphorus on a solution of, 50.

iodate, estimation of, 99.

nitrite, molecular conductivity of, 102.

mercurinitrite, molecular conductivity of, 102.

n-Propane, $\alpha\gamma$ -diamino-, benzoyl derivative, 293.

Propano- $\alpha\beta$ -dicarboxylic acid, γ -cyano-, ethyl ester, 193.

Propionylcyanoacetic acid, β -chloro-, ethyl ester, 103.

Purpurogallin, 94.

Purpurogallone, constitution and derivatives of, 94.

*iso*Purpurogallone, and its constitution and derivatives, 94.

Pyridine ethonitrite, 53.

2:3:4:5-tetrachloro-, action of sodium methoxide on, 165, 234.

Pyromellitic acid, preparation of, 243.

Pyronine colouring matters, 285.

Quercetin pentaethyl ether, 328.

Quinoline derivatives, 164.

*iso*Quinoline derivatives, 161, 228.

p-Quinones, action of semicarbazide hydrochloride on, 256.

Quinone-ammonium derivatives, 128.

Racemic compounds, existence of, in the liquid state, 286.

morphotropic relations between, and their optically active components, 165.

Radioactive change, formation of neon as a product of, 182.

Refraction. See under Photochemistry.

- Rhubarb, constituents of, 96.
 Rotation and Rotatory power. See under Photochemistry.
 Rubreserine, and its salts, 125.
 Safranines, constitution of the, 231.
- Salicin, α -amino-, 320.
 Salicylbenzamidine, 5-chloro-, 6.
 Salicylidene-*o*-anisidine, 237.
 Salicylidene- β -naphthylamine, colour changes in, 237.
 Santalin and its derivatives, 139.
 Saponarin, blue compound of iodine with, 157.
 Satinwood, West Indian, constituents of, 143.
 Scammony root and scammony, constituents of, 39.
 Semicarbazide hydrochloride, action of, on *p*-quinones, 256.
 Semicarbazones, 192.
 Stromerajin, 53.
 Silicon organic compounds, 243, 244, 245.
 Silver nitrate, concentration cell, 239.
 salts, action of halogens on, 225, 314.
 Soap, constitution of, in solution, 237.
 Sodium, boiling point of, 3.
 hypobromite, action of, on carbamide derivatives, 144.
 hypochlorite, photo-kinetics of solutions of, 288.
 cupric hydrogen ferrocyanide, 317.
 oxide, acetic anhydride and water, equilibrium in the system, 16.
 hyposulphite, action of copper sulphate on, 101.
 Solutions, solid inorganic, photophorescence of, 2.
 Solvates, detection of, in mixtures of liquids, 128.
 Solvents, influence of, on the rotation of optically active compounds, 8, 224.
 Spectra. See under Photochemistry.
 Starch, blue compound of iodine with, 157.
 Stilbene, *p*-hydroxy-, and its derivatives, 69.
 Substance, $C_{11}H_{10}O_3$ from West Indian satinwood, 143.
 $C_{14}H_{12}O_3$ from West Indian satinwood, and its derivatives, 143.
 $C_{15}H_{14}O_7$ and its acetyl derivative, from ergot, 71.
 Succinic acid, *s*-dibromo-, action of allylamine on, 224.
 Succinic acids, *d*ibromo-, configuration of the stereoisomeric, 160.
 Succinylbismethylnitrosoamide, 65.
- Sulphonic esters, preparation and properties of, 18.
 Sulphylic acids, reactions of, 329.
 Sulphur, refractivity of, in aliphatic compounds, 159.
 action of, on *o*-toluidine, 222.
 oxidation of benzyl compounds of, 242.
- Taraxacum root, constituents of, 285.
 Taraxasterol, 285.
 Tartaric acid, ethyl ester, effect of inorganic salts on the rotation of, 224.
 action of chloral on, 101.
 Terpenes, chemistry of the, 187, 270, 314.
 Terpene alcohols, catalytic action of copper on, 53.
 α -Terpineol, formation of, from pinene, 270.
s-Tetrabenzoylthane, 145.
 Tetrabenzylstannane, 314.
 Tetrahydroberberine, alkylation of, 160.
 α - and β -Tetrahydrodinaphthanthracenes, 243.
 $\alpha\epsilon$ -Tetrahydro-2-naphthol, rotation of, and its esters, 137.
 Tetrahydro-oxazoles, formation of, 315.
 Tetrahydroquinaldine derivatives, relation between constitution and rotatory power amongst, 275.
 Tetrahydroquinoline derivatives, 164.
 Tetrakisazobenzene, 233.
 1 : 3 : 4 : 5-Tetraphenyl-2 : 3-dihydro-2-glyoxal-one, and -thione, 287.
 Thallium, production of a steady flame of, 65.
- THERMOCHEMISTRY :—
 Thermostat, simple vapour, 189.
 Heat of vaporisation, latent, of mixed liquids, 128.
 Thermotropy, studies in, 236.
 Thiobenzanilide oxide, sodium salt, 330.
 Thiocarbamide, new structural formula for, 241.
 dynamic isomerism of ammonium thiocyanate and, 141, 233.
 action of nitrous acid on, 241.
 interaction of iodine and, 240.
 Thiocarbamides, constitution and reactions of, 265.
*iso*Thiohydantoins, substituted, 54.
 Time-reactions suitable for lecture experiments, 254.
 Tin organic compounds, 313.
 Tin, estimation of, 102.
 Tolueneazo- β -naphthylamines, 232.
o-Toluidine, action of sulphur on, 222.
m-Toluidine, effect of heat on a mixture of benzaldehydecyanohydrin and, 266.

- 1-*p*-Tolyl-1 : 2 : 4-*tri*aminonaphthalene, 325.
p-Tolynaphthatriazoles, 325.
 1-*p*-Tolyl- α -naphthylamine, 2 : 4-*di*-nitro-, 325.
 Triacetoneamine, nitroso-, catalytic decomposition of, 291.
 Trialkylammonium nitrites, 53.
 Triazo-compounds, refraction and dispersion of, 226.
 Triazo-group, the, 50, 219.
 β - and γ -Triazopropylamines, 50.
 Tribenzylethylstannane, 314.
 Tribenzylstibine oxide and dichloride, 69.
 Triketomethylenedioxyhydrindene, 95.
 $\alpha\alpha\beta$ -Trimethyladipic acid, β -hydroxy-, 219.
 1 : 1-Trimethylenepiperidinium hydr-oxide, action of heat on, 230.
 Trimethylenetetrahydroisoquinolinium iodide, 221.
 1 : 3 : 4-Triphenyl-2 : 3 - dihydro - 2- gly-oxalone, 331.
 1 : 3 : 4-Triphenyl-2 : 3 - dihydro - 2- gly-oxalathione, 331.
 Triphenylmethane group, azo-colouring matters of the, 137.
 3 : 4 : 5-Triphenyl-2 : 3 : 4 : 5-tetrahydro-2-oxazolone, 315.
 2 : 4 : 6-Triphenyl-1 : 3 : 5-triazine, 5'-chloro-2'-hydroxy-, 6.
 Tripropylammonium nitrite, 41.
 Trithio-*o*-toluidine and its derivatives, 222.
 Tyrosine and its derivatives, 160.
 action of oxydases on derivatives of, 140.
 amino-, constitution of, 140.
 Unsaturated centres, effect of, on absorptive power, 71.
 Unsaturated groups, effect of relative position of two, on viscosity, 269.
p-Urazine, preparation of, 144.
 Valency, 253.
 Vanadium acylacetates, 325.
 oxybisacetylacetate and teracetyl-acetate, 199.
 Van't Hoff memorial fund, 112.
 Vapour pressure, determination of molecular weights from the relative lowering of, 96.
 Veratrylidene-7-methoxychromanone, 7.
Vernonia anthelmintica, constituents of the seeds of, 53.
 Viscosity and association, 51, 286.
 relation between chemical constitution and, 269.
 of amines, 70.
 Wade, Dr. J., reference to decease of, 248.
 Walden inversion, experiments on the, 40.
 Water, fractional distillation of, 186.
 conductivity water, preparation of, 3.
 spring and mineral waters of Bath, analysis of the, 183.
 Weights, molecular, determination of, from the relative lowering of vapour pressures, 96.
o-3-Xylenol, 4 : 5-*di*bromo-, 333.
 Xylenols, bromo-, from dimethyldi-hydroresorcinol, 332.
 Yeast, preparation of glycogen and yeast-gum from, 235.
 Yeast-gum, preparation of, from yeast, 235.
 Zinc, boiling point of, 3.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 395.

Thursday, January 18th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. Rufus Gaunt and Harold King were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Clement William Bailey, M.Sc., Evington, Leicester.

James Ewart Bridge, B.Sc., Sarnia, Hatfield Road, Ipswich.

William Thomas Clarke, B.Sc., Mansfield Road, Heanor, Derbyshire.

Surendranath De, 21, Srigopal Mullick Lane, Calcutta, India.

Wilfrid James Fleet, Imatra, King's Road, Bournemouth.

Isidor Morris Heilbron, Ph.D., 7, Claremont Terrace, Glasgow.

Charles James, New Hampshire College, Durham, N.H., U.S.A.

James William McMyn, 35, Snowdon Road, Eccles, Manchester.

Pestanji Manekji Modi, B.A., Meher Buildings, Tardeo, Bombay, India.

Richard Gillies Neilson, Burma Oil Co., Ltd., Rangoon, Burma.

John Wilfrid Parkes, 14, Gower Terrace, Willenhall, Coventry.

Edgar Alexander Rayner, B.Sc., 71, Welldon Crescent, Harrow.

Henry Edgar Smith, M.Sc., The Mount, Dawley, Salop.
 Percy Rudolph Strivens, The Crofts, Horbury, Wakefield.
 Forsyth James Wilson, D.Sc., Ph.D., 96, Great George Street,
 Glasgow.

The PRESIDENT announced that the Moissan Memorial Lecture would be delivered by Sir William Ramsay, K.C.B., LL.D., F.R.S., on February 29th, 1912, at 8.30 p.m.

Of the following papers, those marked * were read :

*1. "The photophosphorescence of inorganic solid solutions."

By A. Lionel Landau.

A study of the literature of phosphorescent inorganic solid substances leads one to the belief that in cathodophosphorescence the phosphorogen is in solid solution, the particular kind of solid solution being colloidal; this theory explains the variation of the colour of the luminescence that a given phosphorogen imparts to different solvents, and also explains the variation of the colour of the luminescence of a given substance at different temperatures.

Cathodophosphorescent substances are not necessarily photothermoluminescent substances, and the theory was propounded that the latter property is due to the presence of colloidal highly positive element in solid solution in addition to colloidal phosphorogen.

The work already published on fluor-spar and zinc sulphide confirms this theory, and it was shown on experimental grounds that it is quite possible that the particular varieties of the alkaline earth sulphides known as "phosphorescent" also contain colloidal positive element. Evidence was adduced against any other theory so far propounded.

It was further suggested on experimental grounds that the flux necessary in alkaline-earth sulphides acts by rendering the sulphide translucent, and the conclusion was drawn that photothermoluminescence can only be exhibited by substances which are translucent or transparent and contain colloidal phosphorogen and colloidal highly-positive element in solid solution.

DISCUSSION.

In reply to the President, Mr. LANDAU said that the authority for the statement that calcium is produced by the reaction between lime and carbon was Moissan (*Ann. Chim. Phys.*, 1899, [vii], 18, 289). Calcium carbide was produced when the carbon was in excess; it was not, so far as he knew, phosphorescent.

***2. "The preparation of conductivity water."**

By Ferdinand Bernard Thole.

The two best known forms of apparatus for the preparation of conductivity water, namely, those designed by Bousfield and by Hartley, Campbell, and Poole, both suffer from two disadvantages, namely, (1) the condenser is somewhat complex and expensive, and (2) as the water is completely cooled before collection the removal of the carbon dioxide and ammonia from the apparatus is slow.

The author described two inexpensive forms of apparatus (one of which may be readily constructed from ordinary laboratory materials), a common feature of which is that steam may be blown through the collected water, thus rapidly removing dissolved gases. The water obtained has an average conductivity of 1.3—1.2 gemmhos (25°), and therefore compares favourably with that obtained under similar conditions by Bousfield's apparatus.

DISCUSSION.

Dr. DUNSTAN pointed out that he had used Mr. Thole's apparatus during the past two years, and had found it most efficient, not only for the purpose it was immediately designed to fulfil, but also for providing a copious supply of pure dust-free water for physico-chemical experiments.

Mr. THOLE agreed with the President that part of the conductivity of the water obtained was due to dissolution of alkali from the glass condenser and receiving flask, especially as those surfaces were exposed for a short time to the action of boiling water.

The object in view, however, was to design a simple and inexpensive apparatus which would yield water sufficiently pure for most ordinary work. Further purification could only be attained by increasing the cost and complexity of the apparatus.

3. "The boiling points of mercury, cadmium, zinc, potassium, and sodium." By Charles Thomas Heycock and Francis Edward Everard Lamplough.

During the course of some work now in progress, the authors had occasion to determine the boiling points of mercury, cadmium, zinc, potassium, and sodium at different pressures. Below are given the values for the boiling points under a pressure of 760 mm. The temperatures were in all cases determined by means of platinum resistance pyrometers. The temperatures assumed in calibrating

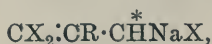
the pyrometers were ice, steam, and the boiling point of sulphur, 444.53° (Callendar and Griffiths):

	Boiling point.	Change in b. p. per mm. at 760.
Mercury	356.7°	0.0746°
Cadmium.....	765.9	0.12
Zinc	905.7	0.133
Potassium	762.2	0.135
Sodium.....	882.9	0.153

4. "The formation and reactions of imino-compounds. Par XVII. The alkylation of imino-compounds." By Jocelyn Field Thorpe.

Evidence was recorded in support of the following generalisations:

(1) Compounds containing the complex $CX_2:CR \cdot CH_2X$, in which X may be any negative group and R any univalent radicle or group, react with sodium ethoxide so as to retain the mobile hydrogen atom, and therefore yield sodium derivatives of the type



in which the mobile hydrogen is represented by an asterisk. The displacement of the sodium in this compound by an alkyl group yields an alkyl derivative, $CX_2:CR \cdot CH(Alk)X$, and the action of sodium ethoxide on this substance causes the displacement of the mobile hydrogen atom, but the metal then takes up the most negative position in the system, yielding the sodium derivative, $CNaX_2:CR:C(Alk)X$.

(2) The imino-compounds react with sodium ethoxide in their amino-form only. They are then derivatives of glutaconic ester, and as such conform to the above generalisation.

5. "1:2-Diketohydrindene." By William Henry Perkin, jun., Walter Morrell Roberts, and Robert Robinson.

The authors showed that 1:2-diketohydrindene, $C_6H_4 \begin{smallmatrix} \text{CO} \\ \diagdown \quad \diagup \\ \text{CH}_2 \end{smallmatrix} \text{CO}$, may be prepared from *isonitroso-α*-hydrindone by treatment with hydrochloric acid in the presence of formaldehyde, and the properties of this substance and those of several of its derivatives were described.

6. "*iso*Narcotine." By Ernest Griffiths Jones, William Henry Perkin, jun., and Robert Robinson.

In order to obtain further evidence in support of the formula suggested for this alkaloid by Perkin and Robinson (*Trans.*, 1911,

99, 777), the authors described some experiments on the condensation of phthaldehydic acid and opianic acid with resorcinol dimethyl ether and catechol dimethyl ether in the presence of hydrochloric acid.

7. "Esterification constants of some substituted acetic and benzoic acids." By John Joseph Sudborough and Margaret Kathleen Turner.

The esterification constants of a number of substituted acetic and benzoic acids have been determined at 15° and 20°, using hydrogen chloride as catalyst.

The relative retarding effects of different substituents are not necessarily the same in the two series.

Acetophenone-*o*-carboxylic and *o*-phenoxybenzoic acids are esterified more readily than benzoic acid.

Hydrogen fluoride is a feeble catalyst as compared with hydrogen chloride.

8. "Aromatic antimony compounds. Part III. Primary aryl derivatives." By Percy May.

Phenylstibinic acid, $C_6H_5 \cdot SbO(OH)_2$, was prepared according to Hasenbäumer's method (*Ber.*, 1898, **31**, 2910), but the product was contaminated with diphenylstibinic acid, $(C_6H_5)_2SbO \cdot OH$. A modification of the method led to the production of pure phenylstibinic acid. The mixture of phenylstibinic and diphenylstibinic acids on nitration yields a mixture of nitro-compounds, from which, by recrystallisation from glacial acetic acid, di-*m*-nitrodiphenylstibinic acid was obtained in yellow needles melting at 210—213° (compare Morgan and Micklethwait, *Trans.*, 1911, **99**, 2294). Reduction of *m*-nitrophenylstibinic acid yielded a small quantity of *m*-antimonylaniline, $NH_2 \cdot C_6H_4 \cdot SbO$, a light, yellow powder, insoluble in water and alkali, soluble in hydrochloric acid. This compound has a powerful irritant action on the mucous membrane. *m*-Aminophenylstibinic acid, $NH_2 \cdot C_6H_4 \cdot SbO(OH)_2$, is produced by the gentle oxidation of this substance, and a very small quantity was isolated in the form of its *chloride*. The *sodium* salt was also obtained, but not in a pure condition.

9. "The aryl ethers of glycide, glycerol, and glycerol- α -monochlorohydrin." By Ernest Robert Marle.

The action between epichlorohydrin and the sodium derivative of a phenol was reviewed, and the methods of preparation described

by Lindeman (*Ber.*, 1891, **24**, 2145), Boyd (*Trans.*, 1901, **79**, 1221), and Boyd and Marle (*Trans.*, 1908, **93**, 838) for glycide ethers and diaryl glycerol ethers, and that described by Boyd and Marle (*Trans.*, 1910, **97**, 1788) for the aryl ethers of glycerol- α -monochlorohydrin have been used to prepare a number of these derivatives so as to complete the series, as far as possible, in the case of some of the more important phenols. The phenylurethanes of the aryl ethers of glycerol- α -monochlorohydrin were also described.

Several new monoaryl ethers of glycerol have been prepared by the action of the sodium derivative of a phenol on glycerol- α -monochlorohydrin.

Evidence was adduced to show that the action of concentrated hydrochloric acid on a glycide ether is to produce γ -chloro- β -hydroxy- α -aryloxypropane, the isomeric β -chloro- γ -hydroxy- α -aryloxypropane being formed, if at all, only in very small amount.

10. "The action of ammonia on 6-chloro-2-phenyl-1:3-benzoxazine-4-one." By Ernest Chislett Hughes and Arthur Walsh Titherley.

Similar observations have been made as to the action of ammonia on 6-chloro-2-phenyl-1:3-benzoxazine-4-one, $\text{C}_6\text{H}_5\text{Cl} \begin{smallmatrix} \text{CO} \cdot \text{N} \\ \diagup \quad \diagdown \\ \text{O} - \text{CPh} \end{smallmatrix}$, to those in the case of the parent ring compound devoid of chlorine.

A bright yellow, crystalline compound, 5-chlorosalicylbenzamidine, $\text{OH} \cdot \text{C}_6\text{H}_3\text{Cl} \cdot \text{CO} \cdot \text{N} : \text{CPh} \cdot \text{NH}_2$, results through rearrangement of the intermediate additive ring-compound formed. By long-continued action of ammonia, 5'-chloro-2'-hydroxy-2:4:6-triphenyl-

1:3:5-triazine, $\text{OH} \cdot \text{C}_6\text{H}_3\text{Cl} \cdot \text{C} \begin{smallmatrix} \text{N} & \text{CPh} \\ \diagdown & \diagup \\ & \text{N} \\ \diagup & \diagdown \\ \text{N} & \text{CPh} \end{smallmatrix}$, is obtained as a pale yellow

solid, and the same compound is produced with great rapidity by the action of benzamidine on 6-chloro-2-phenyl-1:3-benzoxazine-4-one. It is also produced more slowly from benzamidine and phenyl 5-chlorosalicylate or 5-chlorosalicylbenzamidine.

11. "The thio-analogues of coumarin and its derivatives."

By Arthur Clayton and William Godden.

Certain nitrothiocoumarins were prepared by heating the corresponding nitrocoumarins with xylene and phosphorus pentasulphide, and their identities established by partial oxidation, which in each case yielded the parent nitrocoumarin. The ketonic structure

present in the thiocoumarins was shown to be preserved in their nitro-derivatives, as the latter compounds yield oximes and hydrazones. The nitrothiocoumarins possess a deep golden colour, thus differing from the nitrocoumarins, which are white; the yellow colour, heretofore stated to characterise 8-nitrocoumarin, was shown to be due to the presence of an impurity.

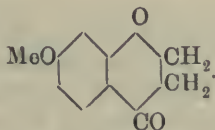
12. "Experiments on the synthesis of brazilin and hæmatoxylin and their derivatives." (Preliminary note.) By William Henry Perkin, jun., and Robert Robinson.

The publication by Tschitschibabin and Nikitin (*J. Russ. Phys. Chem. Soc.*, 1911, **43**, 1185) of a note on 3-methoxydihydro-1:4-benzopyrone leads the authors to submit the results of a research on the same subject, on which they have been engaged at intervals during the last two years.

m-Methoxy- β -phenoxypropionic acid,

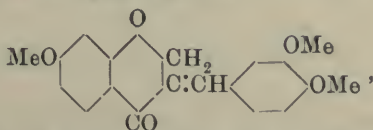


was obtained by the interaction of resorcinol monomethyl ether and β -iodopropionic acid in aqueous alkaline solution, and also by the hydrolysis of the ester resulting from the condensation of sodio-resorcinol monomethyl ether and ethyl β -iodopropionate. It crystallises from water in shining leaflets melting at 82° , and dissolves in nitric acid to an intense green solution, which becomes bluish-green after dilution with water. On treatment with phosphoric oxide in benzene solution, under the same conditions as were used for the preparation of dimethoxyhydrindone (*Trans.*, 1907, **91**, 1080), this acid is easily converted into 7-methoxy-2:3-dihydro-1:4-benzopyrone (7-methoxychromanone),



The ketone is best purified by distillation, and boils at $197^\circ/30$ mm. It crystallises from light petroleum in colourless needles melting at 56° . The semicarbazone crystallises from alcohol in small, glistening plates, melting and decomposing at 222° .

Veratrylidene-7-methoxychromanone,

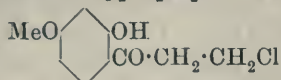


is closely related to trimethylbrazilin, and is obtained by treatment

of equimolecular quantities of methoxychromanone and veratraldehyde in methyl alcohol with potassium hydroxide. It consists of almost colourless needles, and can be easily crystallised from ethyl or methyl alcohols. It is rather sparingly soluble, melts at 140° , and dissolves in sulphuric acid to an intense crimson solution. Indications have already been obtained that it is possible to convert this substance into a derivative of brazilin.

The poor yield obtained in the preparation of methoxyphenoxypropionic acid led the authors to investigate other methods of preparation of methoxychromanone, but up to the present time they are unable to dispense with that described above.

ω-Chloro-2-hydroxy-4-methoxypropiphenone,



is produced by the condensation of resorcinol dimethyl ether and β -chloropropionyl chloride in light petroleum solution in the presence of anhydrous aluminium chloride. It crystallises from methyl alcohol in groups of colourless needles. On heating, it softens at 98° , and undergoes no further change until the almost liquid substance becomes transparent at 138° . Decomposition also occurs at this temperature. It gives a violet coloration with ferric chloride, and has the irritating properties of chloro-ketones. On treatment with alkalis the production of methoxychromanone was expected, but instead a substance is quantitatively produced, which crystallises from ethyl acetate in colourless needles melting at $249\text{--}250^{\circ}$. The nature of this compound has not yet been completely elucidated.

13. "The influence of solvents on the rotation of optically active compounds. Part XVII. The relationship between the chemical constitution and the influence of a solvent." By Thomas Stewart Patterson and Elizabeth Findlay Stevenson.

The influence of a number of solvents in modifying the rotation of an optically active ester was described and discussed in connexion with the chemical constitution of the solvent.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Aberdeen, University of. Subject catalogue of the Phillips Library of Pharmacology and Therapeutics. Aberdeen 1911. pp. 240. 2s. 6d. (*Recd.* 29/12/11.) From the University.

Bristol and Clifton Hotwells. A few words on the Bristol and Clifton Hotwells. Together with an analysis of the Spa by William Herapath. Bristol [1854]. pp. 24. From Dr. A. Scott, F.R.S.

Herapath, William. See **Bristol and Clifton Hotwells.**

Hoppe-Seyler, Ernst Felix Immanuel [Editor]. Medicinisch-chemische Untersuchungen. Aus dem Laboratorium für angewandte Chemie zu Tübingen. Berlin 1866-1871. (*Reference.*)

From Dr. R. H. Aders Plimmer.

Institute of Brewing. Collective index of the Journal, [*&c.*] 1887 to 1910. Compiled by *William H. Bird*. London 1911. pp. iv + 550. 10s. 6d. (*Reference.*) From the Institute.

Maurantonio, Leonardo. L'arsenico nella scienza, nell' industria e negli avvelenamenti. Milano 1912. pp. xii + 256. ill. L2.50. (*Recd.* 1/1/12.) From the Publisher: *Ulrico Hoepli.*

Saint Andrews, University of. *Five hundredth Anniversary.* Memorial volume of scientific papers contributed by Members of the University. Edited by *William Carmichael M'Intosh, John Edward Aloysius Steggall*, and *James Colquhoun Irvine*. Edinburgh 1911. pp. xi + 354. 10s. 6d. (*Recd.* 21/12/11.)

From the University.

Spencer, James Frederick. An experimental course of physical chemistry. Part II. Dynamical experiments. London 1911. pp. xvi + 256. ill. 3s. 6d. (*Recd.* 21/12/11.) From the Author.

II. *By Purchase.*

Abderhalden, Emil [Editor]. Biochemisches Handlexikon. Vols. I to VII. i. Berlin 1911. M. 324.—. (*Reference.*)

Angeli, A. Neue Studien in der Indol- und Pyrrolgruppe. (Sammlung, Vol. XVII.) Stuttgart 1911.

Cameron, Frank K. The soil solution: the nutrient medium for plant growth. Easton, Pa. 1911. pp. vi + 136. \$1.25. (*Recd.* 4/1/12.)

Classen, Alexander. Theorie und Praxis der Massanalyse. Leipzig [1911]. pp. ix + 772. M. 30.—. (*Recd.* 29/12/11.)

Couper, Archibald Scott. Über eine neue chemische Theorie. Edited by **Richard Anschütz.** (Ostwald's *Klassiker*, No. 183.) Leipzig 1911. pp. 40. M.1.—. (*Recd.* 17/12/11.)

Ehrlich, Felix. Ueber die Bedeutung des Eiweiss-stoffwechsels für die Lebensvorgänge in der Pflanzenwelt. (Sammlung, Vol. XVII.) Stuttgart 1911.

Graham, Thomas. Abhandlungen über Dialyse (Kolloide). Edited by **E. Jordis.** (Ostwald's *Klassiker*, No. 179.) Leipzig 1911. pp. 179. M. 3.—. (*Recd.* 17/12/11.)

Jellinek, Karl. Das Hydrosulfit. Teil I. Grundzüge der physikalischen Chemie des Hydrosulfits im Vergleich zu analogen Schwefelsauerstoffderivaten. (Sammlung, Vol. XVII.) Stuttgart 1911.

Schwalbe, Carl G. Die Chemie der Cellulose. Part II. Berlin 1911. pp. 273 to 666 + xii. M. 16.80.—. (*Recd.* 29/12/11.)

Virgili, Juan Fages y. Die indirekten Methoden der analytischen chemie. (Sammlung, Vol. XVI.) Stuttgart 1911.

Weigert, Fritz. Die chemischen Wirkungen des Lichts. (Sammlung, Vol. XVII.) Stuttgart 1911.

III. Pamphlets.

Benjamin, Marcus. American art pottery. (From the *Glass and Pottery World*, 1907.)

Bruce, W. Report on cattle-feeding experiments with soya-bean cake. (*Edinburgh and East of Scotland Coll. of Agric., Report*, 25. 1911.)

Chacón, Aníbal. La molécule cyclique. Une nouvelle hypothèse sur le benzène allotropie et polymérie. Montevideo 1911. pp. 43.

Egypt, Survey Department. A report on the work of the Laboratories in 1910. By **A. Lucas.** Cairo 1911. pp. 21.

Lucas, Alfred. Preservative materials used by the ancient Egyptians in embalming. Cairo 1911. pp. 59.

Seubert, Karl. Gedächtnisfeier bei der Enthüllung des Marmorbildnisses von Professor Dr. Lothar Meyer im grossen Hörsaal des neuen chemischen Universitäts Laboratoriums zu Tübingen am 3 August, 1911. Tübingen 1911. pp. 22.

ERRATA.

PROCEEDINGS, 1906.

P. 105, line 6 from top for "thiocarbimide" read "thiocarbamide."

P. 111, „ 8 „ „ „ „ "3:5-dibromo-4-acetonylbenzoic" read "3:5-dibromo-4-acetoxybenzoic."

At the next Ordinary Scientific Meeting on February 1st, 1912, at 8.30 p.m., the following papers will be communicated:

"The constituents of commercial chrysarobin." By F. Tutin and H. W. B. Clewer.

"Researches on bleaching powder. Part II. The action of dilute acids on bleaching powder." By R. L. Taylor and C. Bostock.

"The quantitative estimation of hydroxy-, amino-, and imino-derivatives of organic compounds by means of the Grignard reagent, and the nature of the changes taking place in solution." By H. Hibbert.

"An exact investigation of the three-component system—sodium oxide, acetic anhydride, water." By A. C. Dunningham.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 396.

Thursday, February 1st, 1912, at 8.30 p.m., Mr. C. E. GROVES,
F.R.S., in the Chair.

Certificates were read for the first time in favour of Messrs. ·

Robert Percy Douglas, Prudential Buildings, Bolton.

Elliott Alfred Evans, College of Agriculture, Holmes Chapel.

Edward Percy Frankland, B.A., Ph.D., M.Sc., The Dell, North-
field, Birmingham.

Walter Elmslie Hawkins, B.Sc., 86, Park Lane, Croydon.

Harold John de Quetteville Lenfestey, 50, Tettenhall Road,
Wolverhampton.

Ambat Kesava Menon, B.A., 45, York Grove, Peckham, S.E.

George Macaulay Painter, B.Sc., Rosemeade, Thundersley, Essex.

Henry Alfred Shute, B.Sc., 102, Meeting House Lane, Peckham,
S.E.

Arthur Wallace, B.A., B.Sc., 1, St. Lawrence Road, Clontarf,
Dublin.

Of the following papers, those marked * were read :

*14. "The constituents of commercial chrysarobin."

By Frank Tutin and Hubert William Bentley Clewer.

Three samples of commercial chrysarobin and one of Araroba
powder have been very fully examined. Chrysarobin was found to

vary considerably in the relative proportions of its constituents, but what may be considered a typical sample had the following approximate composition: Chrysophanic acid (5 per cent.); emodin monomethyl ether (2 per cent.); the anthranol of chrysophanic acid, which was described by Jowett and Potter (*Trans.*, 1902, **81**, 1575) under the name of "chrysarobin" (46 per cent.); the anthranol of emodin monomethyl ether (a small amount); *monomethyl ether of dehydroemodinanthranol*, $C_{16}H_{12}O_4$ (18 per cent.); *ararobinol*, $C_{23}H_{16}O_5$ (4 per cent.); and an inseparable mixture of substances, together with amorphous material (about 25 per cent.). One specimen of chrysarobin was devoid of ararobinol, whilst another contained a little emodin.

The Araroba powder, in addition to the above-mentioned constituents of the chrysarobin, contained an appreciable amount of emodin, a small amount of a sugar which yielded *d*-phenylglucosazone, and traces of the higher fatty acids and a substance which appeared to be a hydrocarbon.

The "dichrysarobin" and "dichrysarobin methyl ether" described by Jowett and Potter (*loc. cit.*) have been shown to be mixtures of the anthranols of chrysophanic acid and of emodin, and the anthranol of chrysophanic acid and the monomethyl ether of dehydroemodinanthranol respectively.

***15. "The existence of molecular compounds in solution. Part I."**
By Harold Langton and Albert Ernest Dunstan.

In an endeavour to show that double salts such as astrakanite have a continued existence in solution, the authors have investigated the viscosity-concentration and viscosity-temperature curves for various solutions containing the mixed sodium and magnesium sulphates and astrakanite itself.

They find that perfectly smooth curves can be constructed, and no change in curvature obtains on passing through the transition point.

Incidentally, the authors have worked out a simple method for the determination of transition points.

16. "Researches on bleaching powder. Part II. The action of dilute acids on bleaching powder." By Robert Llewellyn Taylor and Clifford Bostock.

The authors have used Taylor's method of determining the proportion of hypochlorous acid and chlorine in a mixture of the two for investigating the action of (*a*) sulphuric, hydrochloric, and

nitric acids; (b) acetic and phosphoric acids; (c) boric and carbonic acids, on a mixture of bleaching powder and water.

When bleaching powder mixed with thirty times its weight of water is distilled with one of the three first acids, in quantity slightly greater than is required to neutralise the free lime, hypochlorous acid with a small amount of chlorine is evolved. When the acid is sufficient to decompose the whole of the hypochlorite present as well, the proportion of chlorine is greater. With larger quantities of acid the amount of hypochlorous acid rapidly diminishes until nothing but chlorine is evolved. There is not much difference in the action of the three acids.

Acetic and phosphoric acids behave much in the same way, using small quantities of acid, but even with comparatively large amounts of acid the proportion of hypochlorous acid does not fall much below 50 per cent.

When bleaching powder is distilled with once or twice its weight of boric acid and a sufficient amount of water, almost pure hypochlorous acid is obtained, and there is not much difference in the result if the boric acid used is as much as three times the weight of the bleaching powder.

When carbon dioxide is bubbled through a mixture of bleaching powder and water at different temperatures, whilst at the ordinary temperature nothing but chlorine is evolved, as soon as the liquid becomes warm some hypochlorous acid is given off. As the temperature rises the proportion of hypochlorous acid increases, until, when the liquid is actively boiling, the distillate is a practically pure solution of hypochlorous acid, hardly any chlorine being evolved.

17. "The quantitative estimation of hydroxy-, amino-, and imino-derivatives of organic compounds by means of the Grignard reagent, and the nature of the changes taking place in solution."
By Harold Hibbert.

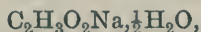
The author finds that the lower fatty alcohols when treated with magnesium methyl iodide in phenetole or amyl ether solution react quite abnormally, the amount of methane evolved falling much below that demanded by theory; thus with methyl, ethyl, and propyl alcohols the methane evolved amounts to only 43, 71, and 83 per cent. respectively. The lower fatty amines also behave abnormally in these solvents, in certain cases no evolution of gas whatever taking place at the ordinary temperature when such derivatives are mixed with the Grignard reagent. Experiments carried out in phenetole solution with fatty and aromatic hydroxy-, amino-, and imino-derivatives always gave too low values. The

cause of this would seem to be (at least, in the case of the lower fatty alcohols) in the formation of two isomeric compounds, namely, (a) $\begin{matrix} \text{R} \\ \text{H} \end{matrix} > \text{O} < \begin{matrix} \text{MgI} \\ \text{CH}_3 \end{matrix}$ and (b) $\begin{matrix} \text{R} \\ \text{H} \end{matrix} > \text{O} < \begin{matrix} \text{Mg} \cdot \text{CH}_3 \\ \text{I} \end{matrix}$, one of which, (a), is stable, the other, (b), unstable, decomposing at the ordinary temperature into methane and $\text{RO} \cdot \text{MgI}$. Evidence was given indicating that on mixing one of the lower alcohols with magnesium methyl iodide in phenetole solution, an equilibrium mixture of the above two isomeric forms is produced.

The conclusion was drawn that the method originally proposed by Hibbert and Sudborough (*Trans.*, 1904, **85**, 933) for the estimation of hydroxyl groups in organic compounds is not generally applicable; only in the case of the aromatic derivatives and where amyl ether (not phenetole) is employed as the solvent, are the results of value. Pyridine (Zerewitinoff, *Ber.*, 1907, **40**, 2023) appears accordingly to be the most suitable solvent for this purpose, but as no experiments have as yet been carried out by him on the lower fatty alcohols and amines in this solvent, no decisive answer can as yet be given regarding this substance. The use of dimethylaniline was suggested as a possible substitute for pyridine.

18. "An exact investigation of the three component system: sodium oxide, acetic anhydride, water." By Alfred Charles Dunningham.

This system has been investigated fully from the point of view of the phase rule between the temperatures 0° and 75° . The author finds the only phases stable between these temperatures to have the formulæ, $\text{C}_2\text{H}_3\text{O}_2\text{Na}$; $\text{C}_2\text{H}_3\text{O}_2\text{Na}, 3\text{H}_2\text{O}$; $\text{C}_2\text{H}_3\text{O}_2\text{Na}, \text{C}_2\text{H}_4\text{O}_2$; and $\text{C}_2\text{H}_3\text{O}_2\text{Na}, 2\text{C}_2\text{H}_4\text{O}_2$. No trace of the hemihydrate,



has been found, although this was given by Dukelski (*Zeitsch. anorg. Chem.*, 1909, **62**, 114) as the phase formed at 30° by the dehydration of $\text{C}_2\text{H}_3\text{O}_2\text{Na}, 3\text{H}_2\text{O}$ by sodium hydroxide.

19. " β -Gnoscopine." (Preliminary note.)

By Edward Hope and Robert Robinson.

The condensation of cotarnine with nitromeconine, resulting in the production of a base, $\text{CH}_2\text{:O}_2 \cdot \text{C}_{18}\text{H}_{11}\text{O}_2(\text{OMe})_3 \cdot \text{NO}_2$, has already been briefly described (Hope and Robinson, *Proc.*, 1910, **26**, 228), and the substance so synthesised was termed nitrognoscopine. The amino-derivative, obtained on reduction, has now been converted into the hydrazine, which, on oxidation, yields not gnoscopine, but a stereoisomeride. It is proposed that *r*-narcotine shall be termed α gnoscopine, whilst the new stereoisomeride is β -gnoscopine.

In consequence, the nitro- and amino-derivatives are nitro- β -gnoscopine and amino- β -gnoscopine respectively.

Hydrazino- β -gnoscopine, $\text{CH}_2\text{:O}_2\text{:C}_{13}\text{H}_{11}\text{O}_2(\text{OMe})_3\cdot\text{NH}\cdot\text{NH}_2$, is prepared by the reduction of diazotised amino- β -gnoscopine with stannous chloride in concentrated hydrochloric acid solution. It crystallises from ethyl alcohol in prisms melting at 205—206°. Copper acetate oxidises it in cold dilute acetic acid solution, and yields β -gnoscopine, $\text{CH}_2\text{:O}_2\text{:C}_{13}\text{H}_{12}\text{O}_2(\text{OMe})_3$.

This substance crystallises in well defined prisms from methyl or ethyl alcohols, or ethyl acetate. It melts at 180°, and the melting point is depressed when the substance is mixed with a small quantity of α -gnoscopine. It forms a sparingly soluble hydrochloride and nitrate, but is in most respects similar to α -gnoscopine and narcotine. On oxidation with dilute nitric acid it yields cotarnine and opianic acid. Its methosulphate is changed on boiling with dilute potassium hydroxide into the potassium salt of narceine, from which pure narceine, identical with the natural product, was isolated.

In view of the large rotation of narcotine and the pronouncedly racemic character of α -gnoscopine, it is provisionally suggested that the α -modification corresponds with racemic acid and the β -form with *i*-tartaric acid. Experiments are in progress having for their object the resolution of β -gnoscopine and also its conversion into α -gnoscopine.

20. "Anhydrohydrastininemeconine." (Preliminary note.)

By Edward Hope and Robert Robinson.

The methods employed for the synthesis of β -gnoscopine (see preceding abstract) have been applied to the synthesis of anhydrohydrastininemeconine, [*dl*(or *r*)- β (or α)-hydrastine]. The various processes give excellent yields so far as the preparation of the hydrazine, and the oxidation of this compound also gives a good yield of crude material, of which only about 50 per cent. is obtained in a pure condition.

Nitro-dl- β (or α)-hydrastine, $\text{CH}_2\text{:O}_2\text{:C}_{13}\text{H}_{12}\text{O}_2(\text{OMe})_2\cdot\text{NO}_2$, is produced by boiling an alcoholic solution of hydrastinine with nitromeconine. It crystallises from trichloroethylene in orange-yellow prisms, which melt at 173°, and decompose a few degrees higher. Its salts resemble those of nitro- β -gnoscopine. On boiling with glacial acetic acid, hydrastinine and nitromeconine are regenerated.

Amino-dl- β (or α)-hydrastine, $\text{CH}_2\text{:O}_2\text{:C}_{13}\text{H}_{12}\text{O}_2(\text{OMe})_2\cdot\text{NH}_2$, is readily produced by the reduction of the foregoing nitro-compound with tin and stannous chloride in glacial acetic and concentrated hydrochloric acid solution. The substance is best crystallised from

chloroform and methyl alcohol, and occurs in rosette-shaped aggregates of prismatic needles. It melts at 214° , and decomposes at a slightly higher temperature. Characteristic of this substance is the very small solubility of the hydrochloride. The amine is very sparingly soluble in ether, and the solution exhibits an intense bluish-violet fluorescence,

Hydrazino-dl-β(or α)-hydrastine, $\text{CH}_2:\text{O}_2:\text{C}_{18}\text{H}_{12}\text{O}_2(\text{OMe})_2\cdot\text{NH}\cdot\text{NH}_2$, obtained in the usual way, crystallises from ethyl alcohol in colourless, hexagonal prisms, and melts at $174\text{--}175^{\circ}$, with evolution of gas at 180° . On oxidation with copper acetate in faintly acid solution it is changed into *anhydrohydrastininemeconine*,



This isomeride of hydrastine crystallises in apparently rectangular prisms from methyl alcohol or ethyl acetate. It melts at 137° , a fact which, combined with the known melting points of narcotine, α - and β -gnoscopines, and hydrastine, would seem to indicate that it is the β - and not the α -form of inactive hydrastine. Since *dl-α*-hydrastine is an unknown substance, it is impossible to state this conclusion with confidence. The methosulphate of the synthesised base yields, on treatment with alkali, methylhydrastine, which crystallises from alcohol in yellow needles melting at 156° , and is identical with methylhydrastine derived from the natural product. These experiments are being continued and extended in various directions, and it is desired to reserve for a short period the investigation of this and similar condensations.

21. "The preparation and properties of sulphonic esters."

By John Ferns and Arthur Lapworth.

The properties of certain sulphonic esters, as well as the question of the applicability of the methods available for the direct conversion of alcohols into sulphonic esters, have been carefully studied. These methods fail completely in certain instances, and the explanation has been found in each case.

Esters of aromatic sulphonic acids resemble the corresponding esters of the halogen hydrides, rather than those of carboxylic acids. The general character of a sulphonic ester, and consequently the most suitable method of preparing it, may often be foreseen when the properties of the corresponding halide ester are known.

The reactions of the esters with amines, potassium alkyloxide, the Grignard and other reagents have been examined in detail. The authors confirm Strecker's observation (*Ber.*, 1910, **43**, 1131 *et seq.*) that ethyl ethanesulphonate yields mainly phenyl ethyl sulphone with magnesium phenyl bromide, but they also detected

ethylbenzene as a product; with ethyl toluene-*p*-sulphonate, on the other hand, this reagent yields only ethylbenzene and no detectable quantity of sulphone.

22. "Menthyl nitrilotriacetate."

By Percy Faraday Frankland and Hugh Henry O'Sullivan.

In endeavouring to prepare menthyl aminoacetate by the action of ammonia on menthyl chloroacetate, the authors have obtained the menthyl ester of Heintz' nitrilotriacetic acid (*Annalen*, 1862, **122**, 269), $N(CH_2 \cdot CO_2 \cdot C_{10}H_{19})_3$. It crystallises in prismatic needles melting at 80.5° . The authors have determined the rotatory power in the fused state and in methyl-alcoholic solution. The relation between the rotation of this and some other menthyl compounds was discussed.

23. "The viscosity of aqueous solutions of sodium palmitate and the influence of electrolytes on the same." By Frederick Denny Farrow.

The viscosity has been measured, at 70° , of aqueous solutions of sodium palmitate up to concentrations of 0.5 gram-molecule per 1000 grams of solution. Over this range the values found are (by interpolation on a smooth curve):

Concentration.	Viscosity (in absolute units $\times 10^5$).	Concentration.	Viscosity (in absolute units $\times 10^5$).
0.0 (water)	0.407	0.3	0.882
0.1	0.540	0.4	1.185
0.2	0.690	0.5	1.800

Determinations were also made of the viscosity of solutions of a definite soap-concentration, in which varying amounts of sodium hydroxide, sodium chloride, or potassium chloride were present. It was found that each of these salts lowers the viscosity when present in small quantity (up to $N/20$ in a soap solution of concentration 0.25). The presence of these substances in larger amounts than these causes a rapid increase in the viscosity of the solution. In each of the three cases the effect of the electrolyte is quite similar, and for sodium hydroxide and sodium chloride the effects are practically identical. The bearing of this phenomenon on the colloidal nature of soap solutions was discussed.

24. "Aromatic amino-derivatives containing antimony." (Preliminary note.) By Gilbert T. Morgan and Frances M. G. Micklethwait.

In reference to an abstract on aromatic antimony compounds recently published by P. May (this vol., p. 5), the authors pointed

out that they have for some time been engaged in studying the reduction products of the nitrated aromatic antimony derivatives, the orientation of which was described in a previous communication (*Trans.*, 1911, **99**, 2294).

Indications were obtained of the production from *m*-nitrophenylstibinic acid of the *m*-aminophenylstibine oxide and the *m*-aminophenylstibinic acid referred to by May. Di-*m*-nitrodiphenylstibinic acid on reduction yielded *di-m-aminodiphenylhydroxystibine*,
 $(\text{NH}_2 \cdot \text{C}_6\text{H}_4)_2\text{Sb} \cdot \text{OH}$:

0.0908 gave 0.1494 CO_2 and 0.0329 H_2O . $\text{C} = 44.87$; $\text{H} = 4.02$.

0.1536 „ 12.0 c.c. N_2 at 17° and 766 mm. $\text{N} = 9.14$.

$\text{C}_{12}\text{H}_{13}\text{ON}_2\text{Sb}$ requires $\text{C} = 44.85$; $\text{H} = 4.04$; $\text{N} = 8.74$ per cent.

The base is a colourless, caseous mass, melting indefinitely at $76-80^\circ$, precipitated from acid solutions by ammonia, and turning brown on exposure.

The *hydrochloride*, $\text{SbCl}(\text{C}_6\text{H}_4 \cdot \text{NH}_2)_2 \cdot 2\text{HCl}$, crystallises from acidified water in very soluble, colourless needles:

0.1849 gave 0.2319 CO_2 and 0.0628 H_2O . $\text{C} = 34.21$; $\text{H} = 3.77$.

0.1538 „ 0.1598 AgCl . $\text{Cl} = 25.71$.

$\text{C}_{12}\text{H}_{14}\text{N}_2\text{Cl}_3\text{Sb}$ requires $\text{C} = 34.90$; $\text{H} = 3.39$; $\text{Cl} = 25.81$ per cent.

The base and its salts have an irritating action on the mucous membrane of the throat and nose, which is even more intense than that noticed in the case of tri-*m*-aminotriphenylstibine and its hydrochloride (*Trans.*, *loc. cit.*).

MOISSAN MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, February 29th, 1912, at 8.30 p.m., when the Moissan Memorial Lecture will be delivered by Sir William Ramsay, K.C.B., F.R.S.

VAN'T HOFF MEMORIAL.

Subscriptions to this fund may be sent to the Treasurer of the Society (Dr. Alexander Scott). The amount already received amounts to sixteen pounds, fourteen shillings.

At the next Ordinary Scientific Meeting on Thursday, February 15th, 1912, at 8 30 p.m., there will be a Ballot for the election of Fellows.

The following papers will be communicated :

"Chemical examination of Scammony root and of Scammony." By F. B. Power and H. Rogerson.

"Experiments on the Walden inversion. Part VIII. α -Amino- α -phenylpropionic acids." By A. McKenzie and G. W. Clough.

"Preparation of the nitrites of the primary, secondary, and tertiary amines by the distillation and sublimation in a vacuum of concentrated solutions of mixtures of the hydrochlorides of the bases and alkali nitrites. Part I." By P. Neogi.

"Nitrites of the mercurialkyl- and mercurialkylaryl-ammonium series." By P. C. Rây, J. N. Rakshit, and R. L. Datta.

"Nitrites of the alkylammonium series. Part IV. *iso*Butyl-, diethyl-, dipropyl-, and tripropyl-ammonium nitrites, and their decomposition and sublimation by heat." By P. C. Rây and J. N. Rakshit.

"Perhalides of diphenyliodonium iodide." By M. O. Forster and J. H. Schaeppi.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N B.—The names of those who sign from "General Knowledge" are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on February 15th, 1912.

Backer, Hilmar Johannes,

4, Upper Bedford Place, London, W.C.

Worker in the Davy-Faraday Laboratory of the Royal Institution. Doctor of Chemistry (Leyden) on a dissertation entitled, "De nitraminen en hunne electrochemische reductie tot hydrazinen, Leyden, 1911." Had a short training in electrochemistry at the Physico-chemical Laboratory of the University of Giessen. Was for five years Assistant at the Organic Chemical Laboratory of the Leyden University.

A. P. N. Franchimont.

T. E. Thorpe.

James Dewar.

William Ramsay.

Hugo Müller.

George Barger.

Bailey, Clement William,

Evington, Leicester.

Student. M.Sc. Birmingham. Priestley Research Scholar.

Percy F. Frankland.

C. K. Tinkler.

Hamilton McCombie.

J. E. Coates.

Percy May.

Barrow, Fred,

Birkbeck College, Breams Buildings, Fetter Lane, E.C.

Lecturer and Demonstrator in Chemistry. M.Sc. (Birm.), Ph.D (Strassburg); 1851 Exhibition Scholar. Publications (with Professor P. F. Frankland): "The Acylbornylamines. I and II." (*Trans.*, 1909); (with Alex. McKenzie) "Experiments on the Walden Inversion. VII." (*Trans.*, 1911).

Percy F. Frankland.

G. W. Clough.

Alex. McKenzie.

A. J. Greenaway.

Hamilton McCombie.

G T. Morgan.

Bearder, Ernest Arthur, M.Sc.,

Mayfield, Wythenshawe Road, Sale, Cheshire.

Research Chemist. Student of Chemistry; six years at the University of Leeds, graduating with First Class Honours in Chemistry (Tinctorial), and subsequently taking the degree of M.Sc. Two years post-graduate research in Tinctorial Chemistry. A research on the "Alkaline Condensations of Nitrohydrazo compounds" (*Trans. Chem. Soc.*, Nov., 1911). Awarded Leblanc medal for special distinction in Honours School of Tinctorial Chemistry. Clothworkers' Research Scholar at Leeds. Silver and Bronze Medallist, City and Guilds of London Institute.

A. G. Green.

Arthur Smithells.

Henry R. Procter.

J. B. Cohen.

H. M. Dawson.

W. Lowson.

W. H. Perkin.

Blackstock, Gibbs,

79, Prince Arthur Avenue, Toronto, Canada.

Assistant, Chemical Staff, University of Toronto. One year's experience in research, Organic Chemistry. Honours graduate (B.A.) in Arts (Chemistry and Mineralogy). One year's work as laboratory instructor in Chemistry.

W. R. Lang.

W. H. Ellis.

W. Lash Miller.

William Ramsay.

Arthur W. Crossley.

Bridge, James Ewart,

"Sarnia," Hatfield Road, Ipswich.

Head Teacher, Nacton Road Council School, Ipswich. B.Sc. (Lond.), First Division, including Chemistry. L.C.P. (Licentiate of College of Preceptors). Late teacher of Chemistry, Ipswich Municipal Secondary School. Late student of Chemistry, Portsmouth Municipal Technical College.

Wm. C. S. Stanger.

H. W. Southgate.

T. Martin Lowry.

J. H. A. Hebron.

W. Briggs.

Brownlie, David,

41, Corporation Street, Manchester.

Consulting Technical Chemist. *Education*: four silver medals, one bronze medal, Technological Examinations of the London City and Guilds; 1st Class Honours, Organic and Inorganic Chemistry, South Kensington; B.Sc. (University of London), Honours in Chemistry. *Experience*: five years assistant technical chemist with Messrs. Levinstein, Ltd., colour manufacturers, Crumpsall; three years technical chemist, two years works manager, Messrs. W. C. Thompson,

Manchester, colour manufacturers; three years technical manager and chemist with Messrs. The United Turkey Red Co., Ltd., Dumbar-tonshire, N.B.; one year works manager, Manchester Dyers, Ltd.; one and a-half years consulting and analytical chemist. *Publications*: "Chemical Action of Light on Dyed Colours," *Soc. Dyers and Colourists*, Dec. 1902; "Some Remarks on the Chemical Action of Light on Dyed Colours," *Soc. Dyers and Colourists*, May, 1910.

Ernest Clark.

Jul. Hübner.

B. Prentice.

W. H. Bentley.

J. R. Appleyard.

Brunjes, Thomas Alfred,

49, St. Donatts Road, New Cross, London, S.E.

Assistant Chemist. Studied Chemistry for four (4) years at the Blackheath School of Chemistry. Assistant for seven years to Arthur J. Dickinson, F.I.C. Eleven years actively engaged in the manufacture of all tar and ammonia products, distillation of rosin, refining oils, bleaching, batching oil, etc.

F. Napier Sutton.

R. M. Harland.

Arthur J. Dickinson.

Rudolph Messel.

Henry Bassett.

Bunker, Sidney Waterfield,

30, York Street, Twickenham, Middlesex.

Analytical Chemist. B.Sc. (1st Class Hons.), 1911. Late Student of King's College under Prof. Jackson, F.I.C., F.C.S., and others. Part author, with John C. Umney, F.C.S., of paper on "Asafœtida" (British Pharmaceutical Conference, 1910). During the past four years engaged in analytical and assay work in laboratories of Messrs. Wright, Layman & Umney, Southwark.

John M. Thompson.

Henry L. Smith.

Herbert Jackson.

John C. Umney.

Patrick H. Kirkaldy.

C. T. Bennett.

Clarke, William Thomas,

Mansfield Road, Heanor, Derbyshire.

Schoolmaster. For seventeen years Science Master of the Heanor Secondary School, and Chemistry Master of the Heanor (Evening) Technical School. Bachelor of Science of the University of London.

F. Stanley Kipping.

W. W. Tunnicliffe.

R. M. Caven.

R. Lloyd Whiteley.

T. Campbell James.

Colclough, Tom Peach, M.Sc.,

47, Vicar Lane, Woodhouse, near Sheffield.

Senior Science Master, the Secondary School, Woodhouse, Sheffield. 1902-6 : Courses of Study for Master of Science in Chemistry at the Victoria University, Manchester ; 1907-9 : Teacher of Chemistry at Ashford Grammar School, and Secondary School, Croydon ; 1909-, Senior Science Master and Lecturer in Science for Miners at the Woodhouse Secondary School.

Harold B. Dixon.

R. Robinson.

Alfred Holt.

Ch. Weizmann.

W. H. Perkin.

E. C. Edgar.

Curtis, Frederic Fernandez,

20, Bury Street, Bloomsbury, London, W.C.

Pharmacist. Member of the Pharmaceutical Society. Pharmacist. Trained at the School of Pharmacy of the Pharmaceutical Society. Was some time with Messrs. Allen and Hanbury, Lombard Street, E.C. Have had two years' experience in Continental pharmacies, and am desirous of doing more analytical work in London.

Arthur W. Crossley.

Charles Gilling.

Chas. Horne Warner.

H. Arnfield.

C. H. Hampshire.

J. E. Coates.

De, Surendranath, L.M.S.

21, Srigopal Mullick Lane, Calcutta, India.

Medical Practitioner. A graduate of the Calcutta Medical College, and an L.M.S. of Calcutta University. A student of Theoretical and Practical Chemistry in 1899 and 1900 in Calcutta Medical College, and passed the Preliminary Scientific M.B. Examination in Chemistry. A student of Theoretical and Practical Chemistry in B.A. Class of the Calcutta St. Xavier's College from 1896 to 1898. A student of Analytical Chemistry in the Indian Association for the Cultivation of Science, Calcutta.

Tarak Nath Majumdar.

Jatindranath Sen.

Haradhan Ray.

Manindra Sinha.

Bidhu Bhusan Dutta.

Dick, Thomas Sharp,

15, South Street, Greenock, Scotland.

Analytical Chemist. Analytical Chemist to Messrs. The Brewers Sugar Co., Ltd., Greenock. Five years Assistant and nine years Chief Chemist to the above Company. I desire to keep in touch with the last investigations in Chemistry.

Lawrence Briant.

Angus Smith.

Harold Harman.

T. L. Patterson.

Jno. Peden.

Dodson, Harold Forster,

6, Lune Street, Saltburn-by-the-Sea.

Analytical Chemist. Studied Analytical Chemistry with Messrs. Pattinson and Stead, Borough Analysts, Middlesbrough. Attended special evening courses in Applied Chemistry at the Sheffield University. At present, Chemist to the Simon Carvé Bye-product, Coke Oven Construction and Working Co., Ltd.

J. E. Stead.

Ernest W. Jackson.

H. Frankland.

L. T. O'Shea.

R. B. Wight.

Ellis, Rowland Holliday, A.I.C.

Hope Cottage, Brayton Road, Selby,

Analytical Chemist. Associate of the Institute of Chemistry. Three years training in the Chemical Department, Leeds University. Five years Assistant to Mr. Thomas Fairley, F.R.S.E., etc., Leeds. For two years, and at present, Chief Chemist to the Olympia Oil and Cake Co., Selby.

Thomas Fairley.

Arthur Smithells.

B. A. Burrell.

J. B. Cohen.

H. M. Dawson.

Fleet, Wilfred James, F.H.A.S., F.E.S.,

"Imatra," King's Road, Bournemouth.

Tutor and Army Coach. Formerly Master and Lecturer on Agricultural Chemistry, 1896-7; Research in Chemistry of Manufacture, etc., of Tea, in Assam, India.

W. G. Sewell.

Chas. Umney.

George Brownen.

Hubert Painter.

W. Hunter Gandy.

W. J. Lewis.

Garbutt, Cornelius Durham,

2, Hartington Road, Garston, Liverpool.

Analytical Chemist. Assistant for six years to G. Watson Gray, Esq., F.I.C.; studied Organic and Inorganic Chemistry at the Liverpool Technical College.

Harold A. Auden.

James Smith.

John W. Towers.

Alexander Watt.

Robert Redwood.

Andrew Turnbull.

Boverton Redwood.

Gaul, Ernest George, M.Sc.,

The College, Holmes Chapel, Cheshire.

Lecturer in Chemistry at the College of Agriculture, Holmes Chapel,

Cheshire. Three years Student in the Honours School of Chemistry, Manchester University. One year Demonstrator in Sanitary Chemistry in the Public Health Laboratories, Manchester University.

Harold B. Dixon.

Norman Smith.

W. H. Perkin.

E. C. Edgar.

H. F. Coward.

Alfred Holt.

Ghosh, Jyotish Chandra,

105, M. C. Ghosh's Lane, Howrah, India.

Secretariat Assistant, Army Department, India. Student for the last 18 months in the Chemistry Department of Manchester University; passed Inter. B.Sc. Selected by the Government of India to be trained as a Pharmaceutical Chemist for employment in Government Medical Stores Department. Author of "Notes on the Manufacture of (i) Drugs and (ii) Surgical Dressings" (Prepared for official use).

Harold B. Dixon.

Norman Smith.

F. P. Burt.

E. C. Edgar.

Alfred Holt.

A. Lapworth.

Gibbins, Richard Ernest,

Clytha, Quinton Road, Coventry.

Chemist. Chemist at Messrs. Wyleys, Ltd., Manufacturing Chemists, Coventry. Passed Pharmaceutical Society's Exam. in 1901. Have studied Chemistry under Prof. Norman Collie in Pharmaceutical Society's School and previously at other Public Institutions. Chemist at General Apothecaries Co., London, W., five years. I am anxious to keep in touch with recent Chemical Research and to have access to the Society's publications.

W. F. Wyley.

J. Norman Collie.

H. W. Jones.

T. E. Wallis.

Ernest W. Mann.

Haines, Thomas Sidney,

73, Kennington Avenue, Bristol.

Junior Assistant in the State Medicine Laboratory, Bristol. Educated at Blackrock College, Co. Dublin. Student at King's College, London, 1906-10. Passed the Examination for the Associateship of the Institute of Chemistry, 1910. Passed the Examination for the Certificate in Biological Chemistry given by the Institute of Chemistry, November, 1911.

John Millar Thomson.

Patrick H. Kirkaldy.

Herbert Jackson.

Edward Russell.

Francis E. Needs

Heilbron, Isidor Morris, Ph.D. (Leipzig), F.I.C., A.G.I.C.,
7, Claremont Terrace, Glasgow.

Lecturer in Chemistry, Glasgow Technical College and Glasgow Veterinary College. Joint-author of several papers on Organic Chemistry published in the *Journal* and *Proceedings* of the Chemical Society and the *Berichte*. Joint-author of the book "The Identification of Organic Compounds."

G. G. Henderson.

Cecil H. Desch.

Frederick Soddy.

Thomas Gray.

Jas. A. Russell Henderson.

James. Charles,

Durham, N.H., U.S.A., and Pytchley Grange, Orlingbury, Wellingborough, England.

Associate Professor of Chemistry, New Hampshire College, Durham, N.H., U.S.A. Six years teaching in N.H. College; three-quarters of a year with National Refining Co., N.Y. City, U.S.A.; five years with Sir W. Ramsay. Fellow of the Institute of Chemistry. Published a number of papers upon rare earths in *Jour. Amer. Chem. Soc.*

William Ramsay.

Samuel Smiles.

J. Norman Collie.

R. Whytlaw-Gray.

N. T. M. Wilmore.

McMillan William,

72, Wellington Street, Greenock.

Chemist. Four years Assistant with Messrs. McCowan and Biggart, Analysts, Greenock. One year with Messrs. Beattie and Co., Sugar Manufacturers, Mauzanillo, Cuba. Chemist to Messrs. Tennants, Ltd., Sugar Manufacturers, San Fernando, Trinidad, B.W.I.

John Wm. Biggart.

Alex. C. Cumming.

William Clacher.

J. P. Longstaff.

Alexander Lauder.

Sydney A. Kay.

T. W. Fagan.

McMyn, James William,

35, Snowdon Road, Eccles, Manchester.

Works Chemist. Student at Royal Salford Technical Institute, 1900-1906. Chief Chemist to Messrs. Arnold Dean & Co., Velvet Dyers, since 1906. Author of "Fluorescein as an Indicator for Coloured Solutions," *Journ. Soc. Dyers and Colourists*, March, 1910.

E. Green.

E. Clark.

B. Prentice.

J. R. Appleyard.

S. Duckworth.

Middleton, Herbert,

7, Howard Street, Horton Lane, Bradford.

Demonstrator in Chemistry, Technical College, Bradford. Have

passed through the three years' Course for Honours Chemistry at Manchester University, and one year's Research. Obtained Degrees of B.Sc. (Honours Chemistry), M.Sc. (Chemical Research).

Harold B. Dixon.

R. Robinson.

W. H. Perkin.

H. F. Coward.

Arthur Lapworth.

E. C. Elgar.

Norman Smith.

Alfred Holt.

Modi, Pestanji Manekji,

Meher Buildings, Tardeo, Bombay, India.

Junior Partner (Dr. E. M. Modi & Co.) and Superintendent, Arthur Road Chemical Works, Bombay. Graduated in Physics and Chemistry as a B.A. of the Bombay University in 1902; received further tuition for two years in Practical and Analytical Chemistry at St. Xavier's College, Bombay, under Prof. Father H. Kemp, S.J., and performed Analytical and Practical Technological Work at the Techno-Chemical Laboratory of Prof. T. K. Gajjar, M.A., B.Sc., etc., for about three years, and then joined Dr. Modi's Arthur Road Chemical Works (Bombay) as Superintendent, assisting his brother, Dr. E. M. Modi, D.Sc., LL.D., F.R.S.E., etc., in Analytical, Manufacturing, and Scientific Research Work for the last four years.

T. K. Gajjar.

A. R. Normand.

E. M. Modi.

G. R. Rele.

A. Pell.

Myers, Ernest Meyer,

c/o The Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent.

Chemist and By-product Coke-Oven Manager. Studied Chemistry at the Central School of Science and School of Technology, Manchester; Technical School, Leeds, and the University of Sheffield. Silver Medallist in Gas Engineering (City and Guilds of London Institute). Two years Assistant Chemist to the Otto-Hilgenstock Coke-Oven Co., Ltd., and five years Chemist to the Grassmoor Colliery Co., Ltd., and Hasland Coking Co., Ltd., Chesterfield.

L. T. O'Shea.

R. L. Taylor.

A. E. Findlay.

F. W. Branson.

O. F. Kirby.

Naunton, William Johnson Smith, B.A. (Cantab.), B.Sc. (Lond.)

1, New Street, Woodbridge, Suffolk.

Research Student. Late Foundation Scholar, Exhibitioner, and Prizeman of St. John's College, Cambridge, and leaving Exhibitioner and Airy Memorial Prizeman of Woodbridge School. First Class in College Examinations, 1908; First Class, Natural Sciences Tripos, Part I, 1909. Second Class, Natural Sciences Tripos, Part II, 1911,

and First Class in the Final examination for Honours in the Faculty of Science of the University of London, 1911. Conjoint author with Dr. Siegfried Ruhemann of a paper on "Diphenylcyclopentenone." At present engaged in research

W. J. Pope.

H. J. H. Fenton.

W. J. Sell.

H. O. Jones.

S. Ruhemann.

Charles T. Heycock.

Neilson, Richard Gillies,
Rangoon, Burma.

Junior Assistant Works Manager, Burma Oil Coy., Ltd., Rangoon, Burma. Formerly Demonstrator in Chemistry; now Chief Chemist and Junior Assistant Works Manager, Burma Oil Coy., Ltd., Rangoon, Burma.

W. Robertson.

J. W. Shepherd.

Andrew Campbell.

Alfred Gordon Salamon.

W. H. Hurtley.

Boverton Redwood.

T. Martin Lowry.

Ogilvie, James Pettigrew,

"Honedale," Hendon Lane, Finchley, London, N.

Analytical Chemist. Certificated Student, City and Guilds of London Institute, Technical College, Finsbury. Late Chief Assistant, Newlands Bros., Analytical and Consulting Chemists.

R. Meldola.

Charles A. Keane.

B. E. R. Newlands.

L. J. de Whalley.

Arthur R. Ling.

Watson Smith.

Parkes, John Wilfrid,

14, Gower Terrace, Willenhall.

Chemical Student. Post-graduate Research Student in the University of Birmingham.

Percy F. Frankland.

C. K. Tinkler.

Hamilton McCombie.

J. E. Coates.

Percy May.

Pope, Rupert William,

10, Malpas Road, Brockley, S.E.

Technical Research Chemist. B.Sc. Hons. London; Tuffnell Scholar, 1910-12. A.I.C. (Mineral Chemistry). Some investigations in Inorganic and Organic Chemistry which have not yet been published. At present engaged on some research work for Messrs. Strange and

Graham, Ltd., 50, City Road, E.C., under the direction of Sir William Ramsay, K.C.B.

J. Norman Collie.

Samuel Smiles.

William Ramsay.

N. T. M. Wilsmore.

F. E. Matthews.

Potter, Howard Vincent,

"Rosemount," Pollard Road, Whetstone, N.

Analytical and Pharmaceutical Chemist in Assay and Pharmaceutical laboratories of Messrs. Wright, Layman & Umney, Ltd. Council Silver Medallist (1910) of Pharmaceutical Society of Great Britain. Two years in School of Pharmacy of Pharmaceutical Society. Three months in research laboratory of Pharmaceutical Society under Prof. Crossley, D.Sc. Ph.D., F.R.S., F.I.C. Eighteen months in Assay laboratory of Messrs. Wright, Layman & Umney, Ltd., Pharmaceutical Chemists.

Arthur W. Crossley.

John C. Umney.

Charles Dorcé.

C. T. Bennett.

Chas. Horne Warner.

Raitt, William,

Dehra Dun, U.P., India.

Cellulose Chemist and Chemical Engineer, and Cellulose Expert to the Government of India. Science Student, Baxter College (now University College), Dundee. Pupil (in Practical and Applied Chemistry) of Dr. Conrad Gerland, Ph.D., at the Blackburn Technical Institute, and of J. T. Ainslie Walker, Esq., F.C.S., Managing Director, Jeyes Sanitary Compounds, Co., Ltd. Author of articles on the chemistry and utilisation of new materials for Papermaking in *World's Paper Trade Review*, 27/9/07, 26/6/08, 2/4/09; *Tropical Agriculturist*, May, June, July, and August, '09, and Jan., '10; *Der Papier-Fabrikant*, Feb. 3rd and June 30th, 1911.

C. G. Moor.

J. T. Ainslie Walker.

Puran Singh.

C. F. Cross.

Edward Bevan.

Rayner, Edgar Alexander, B.Sc. (London),

71, Welldon Crescent, Harrow-on-the Hill.

Analytical Chemist. Six years with Messrs Johnson & Sons, Assayers, Ltd., 23, Cross Street, Finsbury, E.C.

Charles A. Keane.

H. Y. Loram.

H. Burrows.

H. R. Cooper.

C. Sordes Ellis.

Roberts, Alfred Reginald,

c/o Canada Cement Co., Shallow Lake, Ontario.

Cement Chemist. Three years Perse School, Cambridge. One year under Prof. Winterstein, Zürich, Switzerland; two years in research work on the rare metals with the Sunbeam Incandescent Lamp Co. Two years in Portland Cement Manufacture in Canada.

W. Lash Miller.

W. H. Ellis.

W. R. Lang.

J. B. Leathes.

H. S. Raper.

Roberts, Walter Morrell,

"The Cedars," Whalley Range, Manchester.

Research Student in Chemistry. Three years student in the Honours Course of Chemistry in the Manchester University; B.Sc. 1910. One year research student under Prof. Perkin; M.Sc. 1911.

Harold B. Dixon.

Norman Smith.

W. H. Perkin.

Arthur Lapworth.

R. Robinson.

Smart, Bertram James,

Travelling to Australia.

Officer in Charge, Government Testing Office, Lithgow, New South Wales. B.Sc. (London), Honours in Chemistry; nine years Research Chemist, Woolwich Arsenal. Joint author of papers with Silberrad on "Chemistry of Nitrogen Iodide: Preparation of *p*-Bistriazobenzene," *J. Chem. Soc.*, 1906, p. 170, 172; and with Robertson, "The Significance of the Abel Heat Test," *J. Soc. Chem. Ind.*, 1910, p. 130. Inventor and Patentee of Aluminium Alloys, Eng. Patents 14940, 1910; 9227, 1911.

Robert Robertson.

J. T. Hewitt.

R. C. Farmer

W. H. Gibson.

John Wade

Smith, Henry Edgar,

"The Mount," Dawley Salop

Student. M.Sc. (Birmingham) Priestley Research Scholarship, Chemistry, 1910; University Research Scholarship, Chemistry, 1911.

Percy F. Frankland.

C. K. Tinkler.

Hamilton McCombie.

Percy May.

Ernest Vanstone.

Smith, Richard,

6, Essex Road, Gorton, Manchester.

Analytical Chemist. Educated at the Municipal School of Technology, Manchester. Nine years Assistant Chemist in the laboratory

of Mr. Frank Scudder, F.I.C. Am desirous of keeping in touch with the latest chemical knowledge.

Frank Scudder.

S. J. Peachey.

Robert Pettigrew.

F. S. Sinnatt.

H. F. Coward.

Strivens, Percy Rudolph,

"The Crofts," Horbury, near Wakefield.

Analytical and Consulting Chemist. I received my training under Mr. R. W. Oddy, F.I.C., Analytical and Consulting Chemist of Rochdale, to whom I was Assistant for upwards of four years. For two years I was Chemist to Messrs. William Lynd & Co., Ltd., Oil Refiners and Soap Manufacturers, of Leeds. For the past six years I have been Chemist and Superintendent of the works of Messrs. John Reid & Son, Oil Distillers, Refiners, Oleine and Stearine Manufacturers, of Horbury. My research work, being of a private nature, has not been published.

William Marshall.

Edward M. Chaplin.

Robt. W. Oddy.

Thomas Fairley.

Sam. S. Pickles.

B. A. Burrell.

Waldron, Cecil Hamersley,

28, Hungerford Road, Camden Road, London, N.

Member of the Literary Staff of Burroughs Wellcome & Co. Two years on the Analytical Staff of the Vinolia Soap Co. Five years on the Literary Staff of Burroughs Wellcome & Co., Manufacturing Chemists.

W. O. Wootton.

Alex. McKenzie.

G. H. Martin.

G. W. Clough.

Harold Deane.

F. B. Power.

Henry Wren.

Wilson, Forsyth James, D.Sc., Ph.D.

96, Great George Street, Glasgow.

Lecturer in Chemistry, Glasgow and West of Scotland Technical College. I have published several papers on Organic Chemistry in the *Journal* and in the *Proceedings* of the Society, and in Liebig's *Annalen*. I studied chemistry at Edinburgh and Leipzig Universities.

G. G. Henderson.

Cecil H. Desch.

Frederick Soddy.

Thomas Gray.

Jas. A. Russell Henderson.

Withers, John Charles,

83, Edgeley Road, Clapham, S.W.

Ph.D. (Würzburg), 1910. Diploma in Chemistry of the Finsbury

Technical College, 1902-5. Assistant to Professor Groves, 1905-7.
Now Assistant to Dr. M. O. Forster.

M. O. Forster.

H. F. Harwood.

G. T. Morgan.

F. P. Dunn.

James C. Philip.

H. V. A. Briscoe.

Chapman Jones.

W. N. Haworth.

Wood, John Kerfoot,

7, Airlie Terrace, Dundee.

Lecturer in Chemistry, University College, Dundee. D.Sc. (Vict.).
Author of following papers published in *Transactions* of Chem. Soc.: "The Affinities of some Feebly Basic Substances," Vol. 83, p. 568; "Bromo- and Hydroxy-derivatives of $\beta\beta\beta'$ -Tetramethyl-suberic acid," 89, 604; "Acidic Constants of some Ureides and Uric Acid Derivatives," 89, 1831; "Affinity Constants of Xanthine and its Methyl Derivatives," 89, 1839; "Amphoteric Metallic Hydroxide," Part I., 93, 411; Part II., 97, 878. Also with Prof. James Walker, of papers published as follows: *Trans.*, 1898, 73, 618; 1900, 77, 21; 1900, 77, 383; 1903, 83, 484; 1906, 89, 598. With E. A. Anderson: *Trans.*, 1909, 95, 979. With J. D. Scott: *Trans.*, 1910, 97, 1573.

Hugh Marshall.

J. C. Irvine.

G. D. Lander.

John Foggie.

John S. Lumsden.

The following Certificate has been authorised by the Council for presentation to Ballot under Bye-law I (3):

Duncan, John,

Victoria Street, Waterloo, Sydney, N.S.W.

Manufacturing Pharmaceutical Chemist. Chemical Works
Superintendent.

J. A. Schofield.

H. A. D. Jowett.

Geo. E. Pearson.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 397.

Thursday, February 15th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

Arthur Leslie Bartow, Kingscot, Ruislip.

Ernest Gower Bryant, 100, Burlington Street, Manchester.

Charles Rugeley Bury, B.A., Ellfield, Wotton-under-Edge, Glos.

James Grainger Hill, 124, Borneo Street, Walsall.

John Owen Hughes, B.Sc., University College of N. Wales,
Bangor.

Edgar Dingle Jones, 3, Neville Road, Waterloo, Liverpool.

Richard Arnold Seymour-Jones, M.Sc., Lyddon Hall, Virginia
Road, Leeds.

William Thornton Lucas, B.A., 62, Mowbray Road, South
Shields.

Bawa Kartar Singh, B.A., Dacca College, Dacca, Bengal.

The PRESIDENT made the following announcements:

(1) That the Council had proposed the following gentlemen as Honorary and Foreign Members, and that a ballot for their election would take place at the Ordinary Scientific Meeting of the Society to be held on Thursday, March 7th:

Professor Philippe A. Guye (Geneva).
 Professor Thomas Burr Osborne (Newhaven, Conn.).
 Professor Paul Walden (Riga).
 Professor Richard Willstätter (Zurich).

(2) That the following changes in the Officers and Council were proposed by the Council :

Vice-Presidents to retire : Prof. J. Norman Collie and Prof. James Walker.

Secretary to retire : Prof. G. T. Morgan.

Ordinary Members of Council to retire : Prof. J. B. Cohen, Mr. C. F. Cross, Mr. C. E. Groves, and Dr. A. E. H. Tutton.

As President : Prof. Percy F. Frankland.

As Vice-Presidents who have filled the office of President : Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Prof. H. B. Dixon, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J. Emerson Reynolds, the Right Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir William A. Tilden.

As Treasurer : Dr. Alexander Scott.

As Hon. Secretaries : Prof. Arthur W. Crossley and Dr. Samuel Smiles.

As Foreign Secretary : Dr. Horace T. Brown.

As Vice-Presidents : Dr. G. T. Beilby, Dr. M. O. Forster, Prof. A. Liversidge, Prof. E. J. Mills, Prof. G. T. Morgan, and Prof. W. J. Pope.

As New Ordinary Members of Council : Dr. H. G. Colman, Dr. A. Harden, Dr. T. M. Lowry, and Dr. E. J. Russell.

(3) That Prof. P. F. Frankland had been appointed to represent the Society at the funeral of the late Lord Lister, P.C., O.M., F.R.S.

(4) That with the object of keeping the Library as up-to-date as possible, the Council would especially welcome the gift of works written by Fellows of the Society.

Dr. F. B. Power, Prof. J. Millar Thomson, and Dr. Samuel Rideal were elected Auditors to audit the Society's Accounts.

A ballot for the election of Fellows was held, and the following were subsequently declared elected :

Hilmar Johannes Backer.
 Clement William Bailey, M.Sc.
 Fred Barrow, M.Sc., Ph.D.
 Ernest Arthur Bearder, M.Sc.
 Gibbs Blackstock, B.A.
 James Ewart Bridge, B.Sc.
 David Brownlie, B.Sc.
 Thomas Alfred Brunjes.
 Sidney Waterfield Bunker, B.Sc.
 William Thomas Clarke, B.Sc.
 Tom Peach Colclough, M.Sc.
 Frederic Fernandez Curtis.
 Surendranath De.
 Thomas Sharp Dick.
 Harold Forster Dodson.
 John Duncan.
 Rowland Holliday Ellis.
 Wilfred James Fleet.
 Cornelius Durham Garbutt.
 Ernest George Gaul, M.Sc.
 Jyotish Chandra Ghosh.
 Richard Ernest Gibbins.
 Thomas Sidney Haines.
 Isidor Morris Heilbron, Ph.D.
 Charles James.

William McMillan.
 James William McMyu.
 Herbert Middleton, M.Sc.
 Pestanji Manekji Modi, B.A.
 Ernest Meyer Myers.
 William Johnson Smith Nauntou,
 B.A., B.Sc.
 Richard Gillies Neilson.
 James Pettigrew Ogilvie.
 John Wilfred Parkes.
 Rupert William Pope, B.Sc.
 Howard Vincent Potter.
 William Raitt.
 Edgar Alexander Rayner, B.Sc.
 Alfred Reginald Roberts.
 Walter Morrell Roberts, M.Sc.
 Bertram James Smart, B.Sc.
 Henry Edgar Smith, M.Sc.
 Richard Smith.
 Percy Rudolph Strivens.
 Cecil Hamersley Waldron.
 Forsyth James Wilson, D.Sc., Ph.D.
 John Charles Withers, Ph.D.
 John Kerfoot Wood, D.Sc.

Of the following papers, those marked * were read:

***25. "Perhalides of diphenyliodinium iodide."**

By Martin Onslow Forster and Johannes Heinrich Schaeppi.

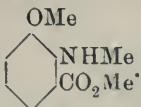
The *tetrachloride*, *dichloride*, *iodochloride*, *dibromide*, and *iodobromide* of diphenyliodinium iodide were described, together with the *dibromide* and *di-iodide* of diphenyliodinium bromide and the *dibromide* and *iodide* of diphenyliodinium chloride.

DISCUSSION.

SIR WILLIAM TILDEN said that this paper interested him because the preparation and properties of certain periodides had been the subject of the first communication he ever made to the Chemical Society. It was curious to notice that the problem presented by the exterior atoms of halogen in these compounds appeared to be in nearly the same position as it was forty years ago. He inquired whether the new compounds presented in the crystalline form the power of polarising ordinary light exhibited by so many of those already known, as, for example, the substance formerly called "herapathite."

***26. "The constitution and synthesis of damascenine, the alkaloid of *Nigella damascene*"** By Arthur James Ewins.

Damascenine has been proved by synthesis to be the methyl ester

of 2-methylamino-3-methoxybenzoic acid, . It thus pos-

sesses the composition $C_{10}H_{13}O_3N$, differing from the formula originally suggested by Schneider (*Pharm. Centr.-h.*, 1890, **31**, 173) only by having two hydrogen atoms less. The formula $C_9H_{11}O_3N$, assigned to this alkaloid by Pommerehne (*Arch. Pharm.*, 1900, **238**, 531), and the betaine-like constitution suggested by Keller (*Arch. Pharm.*, 1908, **246**, 1) are therefore without foundation, the "damascenine hydrochloride" of these workers being a mixture of the hydrochlorides of damascenine and damasceninic acid.

***27. "The action of ozone on cellulose."**

By Mary Cunningham and Charles Dorée.

Ozone (concentration 1 to 2 per cent.) rapidly attacks cotton, forming a cellulose peroxide and an acid derivative, together with some carbon dioxide. The peroxide is decomposed at 80° . The acid may be removed by boiling with water or digestion with $N/10$ -alkali; the neutral fibre residue then obtained is an oxycellulose. The acidity and the amount of carbon dioxide produced during treatments varying from one to twenty hours have been measured, and the constants of the oxycellulose determined and compared with typical oxycelluloses.

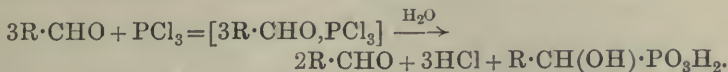
The lignocellulose jute is not appreciably affected unless water is present. In that case it is oxidised, giving carbon dioxide, acetic and formic acids, and complex non-volatile acids which yield furfuraldehyde. Quantitative measurements of the progressive action of the ozone show that the lignone group is rapidly attacked in the first three hours, after which the action becomes slower, the residue being then oxidised uniformly. The lignin reactions cease when the loss of weight is about 33 per cent. Direct evidence of ozonide formation has not been obtained, although the formation of acetic and formic acids appears to be due to the decomposition of some product formed, in the first instance, by the action of ozone.

***28. "Hydroxymethylphosphinic acid and some homologues."**

By Harold James Page.

Fossek found that when an aldehyde (3 mols.) and phosphorus trichloride (1 mol.) were mixed, an unstable viscous oil resulted.

When this was treated with water, two-thirds of the original aldehyde was regenerated, together with hydrogen chloride and α -hydroxy-alkyl(or aryl)-phosphinic acid,



Fossek's results have been confirmed, and the above reactions further examined. An attempt to distil the intermediate oil in a vacuum was fruitless. An explanation of the mechanism of the reaction and of the constitution of the intermediate oil was, however, advanced.

The first member of the series, namely, hydroxymethylphosphinic acid, was not prepared by Fossek. It has been obtained in a 93 per cent. yield by the action of trioxymethylene on phosphorus trichloride, and it has been shown that it is also produced by the action of formaldehyde on phosphorus trichloride, although not in a pure state.

Hydroxymethylphosphinic acid, $CH_2(OH) \cdot PO_3H_2$, is in most respects similar to the other members of the series; as typical member, however, it exhibits certain anomalous properties.

DISCUSSION.

Mr. C. HOLLINS drew attention to the ethereal oxygen linking in one of the suggested intermediate compounds, and asked the author whether the acids showed any tendency to form inner anhydrides.

Dr. J. F. SPENCER pointed out that all the compounds described, except the first member of the series, contained asymmetric carbon atoms, and asked whether the author had any evidence of the existence of the two optically active isomerides in any of the compounds examined.

Mr. PAGE replied that no indication of the formation of an inner anhydride had been observed, and that he proposed to attempt the resolution of some of the acids.

29. "Chemical examination of scammony root and of scammony." ederick Belding Power and Harold Rogerson.

The material employed for this investigation consisted of Levant scammony root (from *Convolvulus Scammonia*, Linné), and the product known as scammony, or "virgin scammony," the latter having been obtained directly from Smyrna.

The scammony root yielded 9.65 per cent. of resin, 97 per cent.

of which was soluble in ether, whereas the gum-resin, scammony, contained 83.1 per cent. of resin, which was completely soluble in ether. The specific rotatory power of the two crude resins was $[\alpha]_D -20.20^\circ$ for that obtained from the root, and $[\alpha]_D -21.15^\circ$ for that from scammony.

For a complete examination of the root, 50.35 kilograms of the ground material were extracted with hot alcohol. The resulting extract, when distilled in a current of steam, yielded a very small amount of an essential oil. From the portion of the extract which was soluble in water the following substances were isolated: scopolin, $C_{10}H_8O_4$; 3:4-dihydroxycinnamic acid, $C_9H_8O_4$; and a small amount of sucrose. The aqueous liquid contained, furthermore, a quantity of dextrose. The portion of the alcoholic extract which was insoluble in water consisted of a resin which possessed the above-mentioned characters.

The resins obtained from scammony root and from scammony respectively, sometimes designated as "scammonin," are very similar in many respects, but not perfectly identical. On the other hand, the resin of scammony root was found to differ very considerably from that obtained from the root of *Ipomoea orizabensis* (Trans., 1912, 101, 1), which has received the appellation of "jalapin." Both of these resins consist of exceedingly complex mixtures, and their components are not entirely glucosidic.

30. "Experiments on the Walden inversion. Part VIII. α -Amino- α -phenylpropionic acids." By Alex. McKenzie and George William Clough.

dl- α -Formylamino- α -phenylpropionic acid was resolved into its optically active components by cinchonidine and quinine, and the amino-acids were prepared by hydrolysing the active formyl compounds with hydrobromic acid. The following values were obtained:

	$[\alpha]_D$
<i>d</i> - α -Formylamino- α -phenylpropionic acid	+ 91.9° in ethyl-alcoholic solution.
<i>l</i> - " " " "	- 91.6 " " " "
<i>d</i> - α -Amino- α -phenylpropionic acid	+ 70.0 in aqueous solution. "
<i>l</i> - " " " "	- 69.5 " " " "

Complete racemisation took place with the formation of *r*-atrolactic acid when the amino-group in the active amino-acids was displaced by the hydroxy-group by means of nitrous acid. Again, when the *d*-amino-acid was acted on by a mixture of fuming hydrochloric acid and sodium nitrite, the racemisation was practically complete.

31. "Preparation of the nitrites of the primary, secondary, and tertiary amines. Part I." By Pañchānan Neogi.

A detailed description was given of the preparation of the nitrites of the primary, secondary, and tertiary amines, a preliminary account of which has already appeared (*Proc.*, 1911, 27, 242).

32. "Nitrites of the mercurialkyl- and mercurialkylaryl-ammonium series." By Prafulla Chandra Rây, Jitendra Nath Rakshit, and Rasik Lal Datta.

By the interaction of mercuric nitrite and the alkyl- and alkylaryl-amines the following mercury-substituted alkyl- and alkylaryl-ammonium nitrites have been obtained: Trimercuridibutylammonium nitrite (compare *Trans.*, 1911, 99, 1972), *mercuriisobutylammonium nitrite*, *mercuribenzylammonium nitrite*, *mercuridiphenylammonium nitrite*, *mercuridi-p-tolylammonium nitrite*, *mercuridibenzylmethylanmonium nitrite*, *mercuridibenzylethylammonium nitrite*, *mercuridipyridinium nitrite*, *mercuridiquinolinium nitrite*, *mercuridinaphthylammonium nitrite*, and *mercuripiperazinium nitrite*.

33. "Nitrites of the alkylammonium series. Part IV. *iso*Butyl-, diethyl-, dipropyl-, and tripropyl-ammonium nitrites." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

By the usual method, namely, double decomposition between the corresponding substituted ammonium chloride and silver nitrite, the above nitrites have been obtained. Of these, *isobutylammonium nitrite* and *tripropylammonium nitrite* are liquids. Diethyl- and dipropyl-ammonium nitrites are crystalline compounds, and can be sublimed in a vacuum without decomposition.

34. "The hydrolysis and saponification of esters of saturated and unsaturated acids." By Thomas Williams and John Joseph Sudborough.

The hydrolysis of the ethyl esters of propionic, acrylic, *n*-butyric, crotonic, β -phenylpropionic, and cinnamic acids by means of dilute hydrochloric acid have been determined at 20°, and also the saponification values of the same esters by means of dilute barium hydroxide.

The results indicate that an unsaturated ester is not nearly so

quickly hydrolysed as its saturated analogue by means of dilute hydrochloric acid. With the three pairs of esters examined, the constant for the saturated ester is about thirty times as great as that for the unsaturated.

The differences in the saponification values are not so marked, and when the unsaturated acid is much stronger than the saturated, as is the case with acrylic and propionic acids, the ester of the unsaturated acid can be saponified more rapidly than its saturated analogue.

35. "Investigations on the dependence of rotatory power on chemical constitution." (Preliminary note.) By Robert Howson Pickard and Joseph Kenyon.

The authors are continuing their investigations, and now find that the method (see *Trans.*, 1911, **99**, 45) of resolving racemic alcohols into their optically active components can be applied to many types of secondary alcohols. For the purposes of these investigations it has already appeared desirable to contrast the properties of series of very closely allied compounds. It is not proposed therefore to publish details of the preparation of isolated members of such series, but the authors desire to reserve this field of research.

Complete resolutions have been effected in the case of the following alcohols, the figures being the rotation, α_D , in a 100 mm. tube at the temperature of the laboratory:

Methyltert.-butylcarbinol, $\pm 6.4^\circ$; α -*naphthylmethylcarbinol*, $\pm 16.0^\circ$; *ethylpropylcarbinol*, $\pm 1.5^\circ$; *ethylisobutylcarbinol*, $\pm 16.3^\circ$; *propylisobutylcarbinol*, $\pm 2.2^\circ$; *benzylmethylcarbinol*, $\pm 26.6^\circ$; *phenylethylmethylcarbinol*, $\pm 14.0^\circ$. Further experiments have shown that the resolution of the following can also be readily carried out: *cinnamylmethylcarbinol*, *cyclohexylmethylcarbinol*, *isopropylisobutylcarbinol*, and *phenyl-o-tolylcarbinol*.

It is further proposed to include in the scope of the investigations such acids as have analogous constitutions to the optically active alcohols obtained. In some preliminary experiments carried out in conjunction with G. T. Byrne, the following optically active acids have been obtained: α -*phenylpropionic acid*, $[\alpha]_D^{20} + 91.8^\circ$, and α -*phenylbutyric acid*, $[\alpha]_D^{20} + 84.8^\circ$.

36. "The methyl, ethyl, and *isobutyl* esters of di-trichloroacetyl-tartaric acid, and the existence of minima in their temperature-rotation curves." By Thomas Stewart Patterson and Alfred Davidson.

The preparation of the methyl, ethyl, and *isobutyl* esters of di-trichloroacetyltartaric acid was described; the rotation values of these esters were quoted and compared amongst themselves and with the data for other analogous compounds. The existence of minima in the temperature-rotation curves of the esters was also commented on.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

American Society for Testing Materials. Memorial volume commemorative of the life and life-work of Charles Benjamin Dudley. Philadelphia, Pa. [n.d.]. pp. 269. ill. (*Recd.* 31/1/12).

From the Society.

Church, Arthur Herbert. Church's laboratory guide. A manual of practical chemistry . . . specially arranged for agricultural students. Revised and partly rewritten by *Edward Kinch*. 9th edition. London 1912. pp. xvi + 368. ill. 6s. 6d. net. (*Recd.* 23/1/12.)

From Professor Edward Kinch.

Dudley, Charles Benjamin. See **American Society for Testing Materials.**

Nisbet, Harry. Theory of sizing. Manchester 1912. pp. xi + 75. ill. 2s. 6d. net. (*Recd.* 10/2/12.)

From the Publishers: Messrs. Emmott and Co., Ltd.

II. *By Purchase.*

Bechhold, H. Die Kolloide in Biologie und Medizin. Dresden 1912. pp. xii + 441. ill. M.14.—. (*Recd.* 14/2/12.)

Hammarsten, Olof. A text book of physiological chemistry. Authorized translation from the . . . seventh German edition by *John A. Mandel*. 6th edition. New York 1911. pp. viii + 964. 17s. net. (*Recd.* 14/2/12.)

Lange, Otto. Die Schwefelfarbstoffe, ihre Herstellung und Verwendung. Leipzig 1912. pp. xii + 497. ill. M.22.—. (*Recd.* 14/2/12.)

Schultz, Gustav. Farbstofftabellen. 5th edition of *Tabellarischen Uebersicht der künstlichen organischen Farbstoffe*. Lief. I. Berlin 1911. M.3.—. (*Reference.*)

MOISSAN MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, February 29th, 1912, at 8.30 p.m., when the Moissan Memorial Lecture will be delivered by Sir William Ramsay, K.C.B., F.R.S.

VAN'T HOFF MEMORIAL.

Subscriptions to this fund may be sent to the Treasurer of the Society (Dr. Alexander Scott). The amount already received amounts to £21 8s. 6d.

The next Ordinary Scientific Meeting will be held on **Thursday, March 7th**, 1912, at **8.30** p.m., when there will be a ballot for the election of Honorary and Foreign Members, and the following papers will be communicated:

“Isomeric change of diacylanilides into acylaminoketones. Transformation of dibenzoyl-*p*-chloro(and -*p*-bromo)-aniline into the isomeric benzoylchloro(and bromo)-aminobenzophenone.” By A. Angel.

“The chemistry of the glutaconic acids. Part III. Glutaconic acid and its β -alkyl derivatives.” By N. Bland and J. F. Thorpe.

“Asymmetric quinquivalent nitrogen compounds of simple molecular constitution.” By W. J. Pope and J. Read.

“The interaction of phosphorus and potassium hydroxide solution.” By M. N. Banerjee.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 28.

No. 398.

Thursday, March 7th, 1912, at 8.30 p.m., Professor J. NORMAN COLLIE, Ph.D., F.R.S., Vice-President, in the Chair.

Messrs. H. J. Backer, John C. Withers, George A. Stokes, Rowland H. Ellis, B. C. Smith, and Thomas A. Brunjes were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Daniel Arkell, B.Sc., Oratory School, Birmingham.

Evelyn Ashley Cooper, B.Sc., Arborfield, Woodcote Valley Road, Purley, Surrey.

Frederick Charles Eastick, B.A., The Drive, South Woodford.

John Burke Farlie, jun., 54, Wellington Road, Old Charlton, S.E.

Oliver Richard Howells, B.Sc., Bracondale School, Norwich.

James O'Mara, B.A., Dunlica, College Road, Dulwich, S.E.

John Rennie, Maisonette, Rufford Park, Yeadon, Leeds.

Arthur Thompson, Bryn Teg, Chetwynd Road, Wolverhampton.

A ballot for the election of Honorary and Foreign Members was held, and the following were subsequently declared duly elected:

Prof. Philippe A. Guye (Geneva).

Dr. Thomas Burr Osborne (Newhaven, Conn.).

Prof. Paul Walden (Riga).

Prof. Richard Willstätter (Zürich).

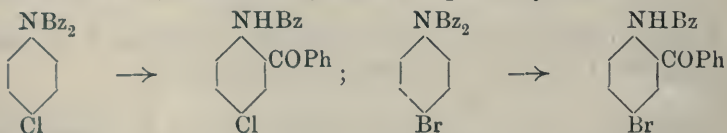
The names of the Fellows recommended by the Council for election as Officers and as Ordinary Members of Council for the year 1912 to 1913 were read from the Chair.

Of the following papers, those marked * were read:

***37. "Isomeric change of halogen-substituted diacylanilides into acylaminoketones." By Andrea Angel.**

The isomeric change of diacylanilides into derivatives of *o*-aminobenzophenone, which has been shown to occur (*Trans.*, 1904, **85**, 386) under the influence of heat and a catalyst when an alkyl group is present in the para-position with respect to the nitrogen atom, has been found to take place in a similar manner if negative para-substituents such as chlorine or bromine are present in the acylated aniline.

Dibenzoyl-p-chloroaniline and *dibenzoyl-p-bromoaniline* undergo rearrangement into 5-chloro-*o*-benzoylaminobenzophenone and 5-bromo-*o*-benzoylaminobenzophenone respectively, thus:



These are pale yellow, crystalline substances, melting at 108° and 122° respectively, which are with some difficulty hydrolysed to the corresponding aminohalogenbenzophenones.

5-Bromo-*o*-aminobenzophenone (m. p. 111°) resembles the chloro-compound (*loc. cit.*, p. 344) very closely. It crystallises from dilute alcohol in bright yellow needles, and is somewhat volatile in steam. It is a weak base, forming crystalline salts with acids, which, however, are so readily hydrolysed that they turn yellow in moist air.

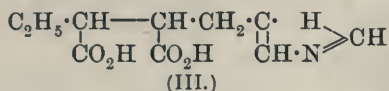
***38. "Studies in the camphane series. Part XXXII. Stereoisomeric modifications of isonitroso-epicamphor, the third and fourth monoximes of camphorquinone." By Martin Onslow Forster and Hans Spinner.**

Although arylimino-derivatives of camphor, when heated with hydroxylamine hydrochloride and sodium acetate, yield either ordinary isonitrosocamphor or the dioxime of camphorquinone (*Trans.*, 1909, **95**, 942), there are produced from phenylimino-camphor in presence of alkali two isomeric oximes. The *α*-oxime,

$\text{C}_8\text{H}_{14} \begin{array}{l} \text{C:N}\cdot\text{C}_6\text{H}_5 \\ \text{C:NOH} \end{array}$, crystallises from alcohol in massive, transparent,

Neither this base nor an *N*-methyl derivative has any pronounced physiological action.

α -4(or 5)-*Glyoxalinemethyl- β -ethylsuccinic acid* (III), a compound



containing the skeleton of pilocarpine, has been prepared by condensing 4(or 5)-chloromethylglyoxaline with ethyl α -cyano- β -ethylsuccinate, and hydrolysing the resulting *ethyl α -4(or 5)-glyoxalinemethyl- α -cyano- β -ethylsuccinate*. Its *ethyl* ester proved to be physiologically inactive. The preparation of 4(or 5)-*glyoxaline-formaldehyde*, $\text{C}_3\text{H}_3\text{N}_2 \cdot \text{CHO}$, was also mentioned, and a description given of the free base, 4(or 5)- *β -aminoethylglyoxaline*.

*40. "Calcium nitrate. Part I. The two-component system, calcium nitrate, water. Part II. The three-component system, calcium nitrate, nitric acid, water at 25°." By Henry Bassett, jun., and Hugh Stott Taylor.

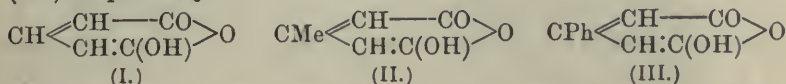
The solubility of calcium nitrate in water has been studied between the temperatures of -28.7° (the cryohydric temperature) and 151° (the boiling point of the saturated solution). There are only three hydrates of calcium nitrate, namely, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$, $\text{Ca}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$, and $\text{Ca}(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$, each of which is stable in contact with its saturated solution over a definite range of temperature. The tetra- and tri-hydrates have true melting points.

The solubility of calcium nitrate increases rapidly with rise of temperature throughout the range of existence of the several hydrates, but at 51° , where the anhydrous $\text{Ca}(\text{NO}_3)_2$ becomes the stable solid phase, the solubility reaches a value which hardly changes with further rise of temperature.

The addition of nitric acid lowers the solubility of calcium nitrate, and at the same time promotes dehydration. Solubility determinations have been made at 25° between the limits of nitric acid concentration of 0 and 98 per cent. In contact with pure water and dilute nitric acid solutions, $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ is the stable solid phase, whilst the anhydrous $\text{Ca}(\text{NO}_3)_2$ is alone stable in presence of the most concentrated acid solutions. Between these two extremes, however, there are well marked intermediate regions, where the stable solid phases are $\text{Ca}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ and $\text{Ca}(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ respectively.

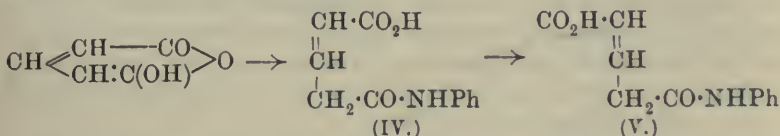
41. "The chemistry of the glutaconic acids. Part III. Glutaconic acid and its β -alkyl derivatives." By Norman Bland and Jocelyn Field Thorpe.

Glutaconic acid, β -methylglutaconic acid, and β -phenylglutaconic acid readily yield hydroxy-anhydrides of the formulæ (I), (II), and (III) respectively:

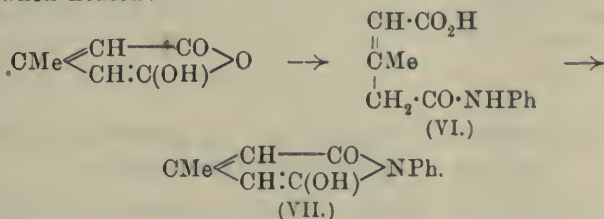


These compounds are monobasic acids, and give intense colorations with ferric chloride.

Glutaconic acid behaves towards aniline in the same manner as its α -mono-substituted derivatives, and the *cis*-semianilide prepared from the hydroxy-anhydride and aniline (IV) passes into the *trans*-semianilide (V) when heated:



The hydroxy-anhydrides from the β -substituted acids yield, on the other hand, semianilides (VI), which pass into hydroxy-anils (VII) when heated:



The hydroxy-anils behave on titration as monobasic acids, but their salts are stable, and do not regenerate the salts of the semianilide when heated. It is evident that the attachment of an alkyl group to the β -carbon atom of glutaconic acid confers increased stability on those forms of the derivatives of the acids which have the mobile hydrogen outside the three-carbon system.

42. "Asymmetric quinevalent nitrogen compounds of simple molecular constitution." By William Jackson Pope and John Read.

In 1891 LeBel described the preparation of methylethylpropyl*iso*-butylammonium salts, and the manner in which, by the action of

Penicillium glaucum on a solution of the corresponding chloride, he obtained a solution which exhibited a small rotatory power; from this observation LeBel concluded that he had succeeded in obtaining optical activity which could be associated with the presence of an asymmetric quinquivalent nitrogen atom.

In 1899 Marckwald prepared salts of the above-named base by the interaction of methylpropylisobutylamine and ethyl iodide, and, since he obtained no optical activity by the action of the organism as described by LeBel, concluded that the latter author's observations were not correct. In a reply to Marckwald, LeBel attributed the failure to confirm his observations to the production of a different quaternary ammonium iodide by Marckwald's process and his own, which consisted in causing ethylpropylisobutylamine to combine with methyl iodide.

The authors have prepared ethylpropylisobutylamine in a state of purity, and have found that it combines with methyl iodide, yielding a quaternary ammonium iodide identical with that obtained by the alternative method used by Marckwald. They find that the behaviour of ethylpropylisobutylamine towards methyl iodide is quite unlike that described by LeBel.

It is consequently concluded that LeBel did not succeed in preparing methylethylpropylisobutylammonium iodide, and that he did not obtain a substance of which the optical activity could be associated with the presence of an asymmetric quinquivalent nitrogen atom.

43. "The interaction of phosphorus and potassium hydroxide solution." By Manindra Nath Banerjee.

An explanation was given, by means of a series of equations, of the mechanism of the reaction between phosphorus and potassium hydroxide solution.

44. "The triazo-group. Part XX. Azoimides of the propane series" By Martin Onslow Forster and John Charles Withers.

By methods, the principles of which are familiar, γ -triazopropylamine was prepared along with β -triazopropylamine, which it greatly exceeds in stability, resembling β -triazooethylamine. $\alpha\gamma$ -Bistriazoisopropyl alcohol and $\alpha\beta$ -bistriazopropyl alcohol were described, together with the respective bistriazochloropropanes; from the former of these $\alpha\gamma$ -bistriazopropylene has been obtained.

45. "Viscosity and association. Part II. The viscosity of geometrical isomerides." By Ferdinand Bernard Thole.

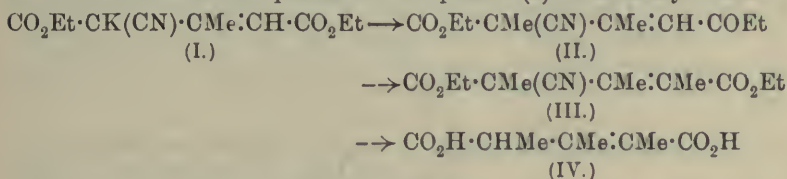
The author has determined the viscosity of a large number of geometrical isomerides, typical members of the ethylenic compounds, the oximes and the phenylhydrazones being examined.

From the results certain general rules have been drawn, by help of which it has been possible to confirm the formulæ for the camphorquinonephenylhydrazones suggested by Forster and Zimmerli (*Trans.*, 1911, **99**, 478), and to assign formulæ to the acetaldehydephenylhydrazones described by Lockemann and Liesche (*Annalen*, 1905, **34**, 214).

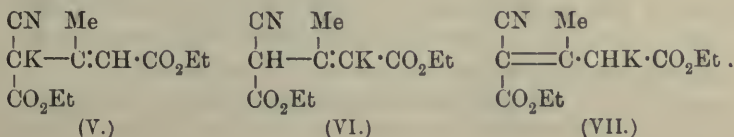
46. "The chemistry of the glutaconic acids. A correction."
By Jocelyn Field Thorpe.

In Part I of this series (*Trans.*, 1911, **99**, 2188) the work previously recorded on the alkylation of esters of the type of ethyl glutaconate was summarised, and it was concluded that under certain conditions the hydrogen atom of the complex $X \cdot CH:$ could be displaced by sodium through the agency of alcoholic sodium ethoxide.

This conclusion was based on the formation of $\alpha\beta\gamma$ -trimethylglutaconic acid (IV) from the ester (III), which was obtained from the ester (II) by the action of sodium ethoxide and methyl iodide; the structure of the last-named substance being evident owing to its formation from the potassium compound (I) and methyl iodide:

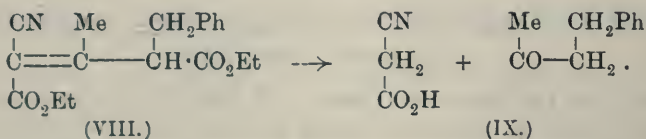


In the original paper (*Trans.*, 1905, **87**, 1674) two possible structures for this potassium compound were considered, namely, (V) and (VI), and of these formula (V) was regarded as the more probable because of the strongly negative character of the hydrogen atom displaced. It is, however, evident, in view of the presence of the mobile hydrogen atom which has since been demonstrated, that there is still another possibility, which is represented by formula (VII):

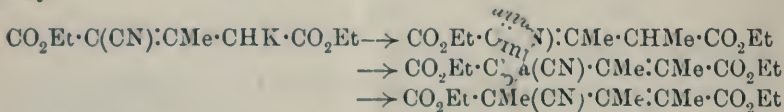


In a recent communication (*Trans.*, 1912, 101, 249) it was shown that the esters of substituted glutaconic acids containing the mobile hydrogen atom react with sodium ethoxide so as to retain this hydrogen, and it is therefore evident that if this statement is true the potassium compound must have the formula (VII), because in order to form a compound of formula (V) the ester would have to part with its mobile hydrogen atom.

Fortunately, it is a very simple matter to prove that the potassium compound has the structure represented by formula (VII), because, when the metal is displaced by benzyl, an ester (VIII) is produced, which is hydrolysed with remarkable ease by alkali hydroxide, yielding cyanoacetic acid and benzylacetone (IX):



It is proposed to give the full experimental details of this curious reaction in a subsequent communication, but it may be stated here that the benzylated ester (VIII) exists in two well-defined modifications, one giving a coloration with ferric chloride and dissolving in alkali, the other giving no coloration and being insoluble in alkali. It is the soluble ester only which undergoes disruption in the above manner. There is, then, no reason to assume that the formation of $\alpha\beta\gamma$ -trimethylglutaconic acid involves the displacement of the hydrogen atom of the complex $\text{X}\cdot\text{CH}$: by sodium, because the course of the reaction can now be represented in the following way:



That is to say, the introduction of the sodium atom in the second operation, involving as it does the displacement of the mobile hydrogen atom, causes the metal to take up the most negative position in the system (compare *Trans.*, 1912, 101, 249).

The following experimental corrections are therefore necessary:

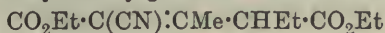
Trans., 1905, 87, 1694, line 21 from top: The formula of the potassium compound should be $\text{CO}_2\text{Et}\cdot\text{C}(\text{CN})\cdot\text{CMe}\cdot\text{CHK}\cdot\text{CO}_2\text{Et}$.

Ibid., 1695, line 4 from top: The name of the ester should be ethyl γ -cyano- $\alpha\beta$ -dimethylglutaconate, and the formula



or $\text{CO}_2\text{Et}\cdot\text{C}(\text{CN})\cdot\text{CMe}(\text{H})\cdot\text{CMe}\cdot\text{CO}_2\text{Et}$.

Ibid., 1708, line 18 from top: The name of the ester should be ethyl γ -cyano- β -methyl- α -ethylglutaconate, and the formula



or $\text{CO}_2\text{Et}\cdot\text{C}(\text{CN})\cdot\text{CMe}(\text{H})\cdot\text{CEt}\cdot\text{CO}_2\text{Et}$.

47. "The catalytic action of copper at 300° on some alcohols of the terpene group." By George Ballingall Neave.

The Sabatier-Senderens test for distinguishing between primary, secondary, and tertiary alcohols (*Bull. Soc. chim.*, 1905, [iii], 33, 263) has been extended to some alcohols of the terpene group. *l*-Borneol was converted into *l*-camphor, fenchyl alcohol into fenchone, and menthol into menthone, all three behaving as secondary alcohols. The following, which are regarded as tertiary alcohols, yielded unsaturated hydrocarbons: terpeneol and terpin gave dipentene; *isoborneol* gave camphene. *Sobrerol*, which contains both a secondary and a tertiary alcoholic group, was converted into pinol.

48. "Preparation of the nitrites of the primary, secondary, and tertiary amines. Part II." By Pañchānan Neogi.

Coniinium nitrite has been isolated, in fairly good yield, from a mixture of the hydrochloride of the base and the alkali nitrites.

49. "Trialkylammonium nitrites and nitrites of the bases of the pyridine and quinoline series. Part III." By Pañchānan Neogi.

Coniinium nitrite, colourless fibrous crystals, sublimes unchanged when heated in a vacuum, and then decomposes with the formation of nitrosoconiine. *Coniine methonitrite* forms a viscous, reddish-yellow liquid. *Piperidine ethonitrite* crystallises in colourless plates. *Pyridine ethonitrite* is a colourless liquid.

50. "The glucoside and oil of *Caesalpinia bonducella*." By Kshitibhushan Bhaduri.

The seeds of *Caesalpinia bonducella* yield an alkaloid, for which the author suggests the name *natin*. The oil has D^{27} 0.9132, iodine value 96.1, and saponification value 292.8.

51. "Constituents of *Vernonia anthelmintica*. Part I." By Kshitibhushan Bhaduri.

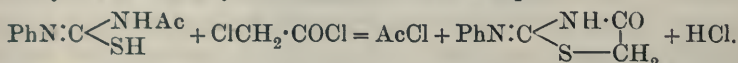
The seeds of *Vernonia anthelmintica* contain a glucoside, to which the name *shomerajin* is assigned. The oil has D^{25} 0.9731, iodine value 91.7, and saponification value 305.7.

52. "Substituted isothiohydantoins."

By Augustus Edward Dixon and John Taylor.

Substituted thioureas (or thiocarbamides), including one, or two, hydrocarbon radicles, when treated with ethyl chloroacetate, produce the corresponding isothiohydantoins. If, however, the thiourea contains an acyl substituent, interaction does not occur.

On the other hand, chloroacetyl chloride readily attacks thioureas containing an acyl radicle, but not with elimination of two hydrogen atoms; instead, the acyl radicle is expelled (yielding an acid chloride), and the residue, joining with the glycolyl group, forms a non-acylated isothiohydantoin; thus, for example:



A trisubstituted thiourea, including purely hydrocarbon radicles, X, Y, Z, unites directly with chloroacetyl chloride. In this case, the linking, $\cdot\text{S}\cdot\text{CH}_2\cdot\text{CO}\cdot$, characteristic of the isothiohydantoins, is not produced, but $\cdot\text{S}\cdot\text{CO}\cdot\text{CH}_2$ instead, the resultant compound behaving as the hydrochloride of a base, $\text{XYN}\cdot\text{C}(\text{NZ})\cdot\text{S}\cdot\text{CO}\cdot\text{CH}_2\text{Cl}$.

N-Diphenylisothiohydantoin, $\text{Ph}_2\text{N}\cdot\text{C} \begin{array}{l} \text{N}\cdot\text{CO} \\ \text{S}-\text{CH}_2 \end{array}$, is formed when chloroacetyl chloride acts on *n*-benzoyl-*v*-diphenylthiourea, *n*-acetyl-*v*-diphenylthiourea, or *v*-diphenylthiourea; it crystallises from alcohol in brilliant, white prisms, melting at 198° (corr.).

The phenylisothiohydantoin obtained from *aa*-acetylphenylthiocarbamide and chloroacetyl chloride is the same as that from the *ab*-isomeride; this is attributed to a preliminary transformation of the former variety into the latter during the course of the interaction.

53. "The conversion of *d*-glucosamine into *d*-glucose." (Preliminary note.) By James Colquhoun Irvine and Alexander Hynd.

The scheme suggested in a previous paper (*Trans.*, 1911, **99**, 250) for the conversion of *d*-glucosamine into *d*-glucose has now been successfully completed, and, pending publication of the detailed results, the authors consider it advisable to outline the reactions in a preliminary note, in view of the fact that other workers have been engaged on the same subject (*J. Amer. Chem. Soc.*, 1911, **33**, 766).

Glucosamine hydrochloride has been converted, as already described (*loc. cit.*), into methylglucosamine hydrochloride. As this compound is here shown to be definitely related to glucose it may now be termed *aminomethylglucoside hydrochloride*. Like other

derivatives of glucosamine, it reacts abnormally with nitrous acid, and although ammonia is evolved when the compound is heated with alkali hydroxides, the reaction seems to be complex, and does not yield methylglucoside. Recourse was therefore had to the silver oxide method of methylation which resulted in the formation of a *methyl aminomethylglucoside* (m. p. 89—90°; $[\alpha]_D^{20} -14.9^\circ$ in methyl alcohol) as the first definite product. Further methylation gave *dimethyl aminomethylglucoside* as a colourless syrup, from which the substituted amino-group was expelled by heating with barium hydroxide. The product, on exhaustive methylation, was converted into tetramethyl methylglucoside, which was identified by analysis, boiling point, and specific rotation.

The removal of the methyl groups was effected in two stages. On hydrolysis with dilute acid, tetramethyl glucose was obtained, and its identity confirmed by analysis, melting point (85—86°), and by the specific rotation in water ($[\alpha]_D +82.1^\circ$). To complete the series of reactions, the alkylated sugar was reduced to the parent hexose by heating with a 40 per cent. solution of hydrogen iodide at 94°. *d*-Glucose, showing the permanent specific rotation $[\alpha]_D^{20} +52.4^\circ$, was thus obtained in good yield.

The conversion of glucosamine into glucose is thus possible through the following reactions:

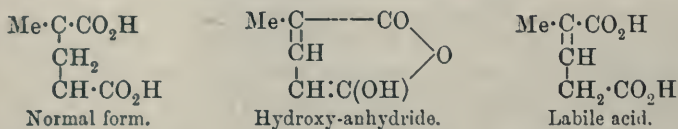
d-Glucosamine hydrochloride \rightarrow bromotriacetylglucosamine hydrobromide \rightarrow triacetyl aminomethylglucoside hydrobromide \rightarrow aminomethylglucoside hydrochloride \rightarrow methyl aminomethylglucoside \rightarrow dimethyl aminomethylglucoside \rightarrow tetramethyl methylglucoside \rightarrow tetramethyl glucose \rightarrow *d*-glucose.

In the course of the work, the salts of aminomethylglucoside were re-examined so as to secure accurate comparison with those described by Fischer (*Ber.*, 1911, **44**, 132). The specific rotations for the hydrochloride and hydrobromide in aqueous solution are now found to be -24.22° and -20.23° respectively, and are thus identical with those found by Fischer. The decomposition points are, however, 190° and 181°, values which are uniformly 25° lower than those quoted by Fischer. It seems possible that in Fischer's aminomethylglucoside the amino-group is attached to the carbon atom in either the β - or ϵ -position to the glucosidic group. This assumption would explain the isomerism of the aminomethylglucosides, and is also in agreement with the production from triacetyl bromomethylglucoside of an anhydroglucose capable of forming anhydrophenylglucosazone (Fischer, *Ber.*, 1912, **45**, 456).

The examination of aminoglucosides prepared from glucosamine is being continued.

54. "The chemistry of the glutaconic acids. Part IV. The structure of the glutaconic acids." By Jocelyn Field Thorpe.

The experimental evidence recorded in the previous parts of this series was reviewed, and the conclusion was drawn that the stable forms of the derivatives of glutaconic acid have a structure similar to that of glutaconic acid itself, in which the tautomeric hydrogen atom is within the three-carbon system and static on the β -carbon atom of this system. The labile acids are those first formed by the hydration of the hydroxyanhydrides, and are in reality the γ -alkyl derivatives of glutaconic acid. The two forms of α -methylglutaconic acid may therefore be represented in this way:



The initial momentum acquired by the hydrogen atom at the moment of its introduction by the hydration of the hydroxy-anhydride carries it, if unchecked, into the three-carbon system; if, however, this "spring" is restrained by alkali or casein, the hydrogen is brought to rest within the carbonyl system.

It was also shown that the esters of the glutaconic acids may be of four distinct types, which may be either tautomeric, desmotropic, or structurally different. Examples of all four types have been isolated and identified.

55. "Epicamphor (β -camphor)." (Preliminary note.)

By Julius Brecht and William Henry Perkin, jun.

Epicamphor (I), the isomeride the ordinary camphor (II), has



been obtained by two processes, namely, (i) in small quantities, from camphanecarboxylic acid by bromination, hydrolysis, and subsequent oxidation of the resulting crude hydroxycamphanecarboxylic acid (Lankshear and Perkin, *Proc.*, 1911, **27**, 166), and (ii) from bornylenecarboxylic acid by conversion into the azide, and then into aminobornylene, which, on hydrolysis with hydrochloric acid, yields epicamphor in a yield of 80 per cent. of that theoretically possible (Brecht and Hilbing, *Chem. Zeit.*, 1911, **35**, 765). A new and convenient process for the preparation of epicamphor has now been worked out, and is briefly as follows:

Methyl bornylenecarboxylate is converted by the action of hydroxylamine hydrochloride and sodium methoxide into *bornylene-hydroxamic acid*, $C_{10}H_{15}\cdot C(OH)\cdot N\cdot OH$, which melts at 136° , and yields an acetyl derivative melting at 112° . When this hydroxamic acid is heated, it undergoes a remarkable decomposition, yielding epicamphor and ammonia, and the sodium salt of the hydroxamic acid is decomposed by toluene-*p*-sulphonyl chloride with the formation of a syrupy substance, from which epicamphor may be obtained in a yield of 60 per cent. of that theoretically possible by treatment with hydrochloric acid and distillation in a current of steam.

Epicamphor melts at $184\text{--}185^\circ$, and is laevorotatory, having $[\alpha]_D - 58.24^\circ$; it yields an oxime (m. p. 103°) and a semicarbazone (m. p. 238°).

Bromoepicamphor, $C_{10}H_{15}OBr$, obtained by heating epicamphor with bromine in 100° , melts at 134° , and has $[\alpha]_D - 69.3^\circ$.

Epiborneol, $C_{10}H_{17}\cdot OH$, is produced when epicamphor is reduced with sodium and alcohol; it melts at $182\text{--}183^\circ$, and yields a urethane melting at 82° ; it is perhaps a mixture of epiborneol and *epiisoborneol*.

When epicamphor is treated with sodamide and *isoamyl nitrite*, it is converted into a mixture of two *isonitroso*-derivatives, $C_{10}H_{14}O\cdot N\cdot OH$, which may be separated by crystallisation from light petroleum. The more sparingly soluble α -*isonitroso*-epicamphor melts at 170° , and has $[\alpha]_D - 201.9$; β -*isonitroso*-epicamphor melts at 140° , and has $[\alpha]_D - 184.3^\circ$, and when it is heated above its melting point it is converted into the α -isomeride. Both the α - and β -isomerides yield camphorquinone on treatment with formaldehyde and hydrochloric acid, and are converted by concentrated sulphuric acid into the imide of camphoric acid (m. p. 244°).

Aminoepicamphor, $C_{10}H_{15}O\cdot NH_2$, is readily obtained when β -*isonitrosoepicamphor* is reduced in alkaline solution by zinc dust. It separates from light petroleum as a satiny, crystalline mass, melts at $163\text{--}170^\circ$, and has approximately $[\alpha]_D + 30.15^\circ$. Experiments on the reduction of α -*isonitrosoepicamphor* are in progress.

Epicamphorcarboxylic acid, $C_{10}H_{15}O\cdot CO_2H$, is produced when sodium or sodamide acts on epicamphor in the presence of carbon dioxide. It melts at 122° , gives a green coloration when ferric chloride is added to its alcoholic solution, and is decomposed, on heating, into epicamphor and carbon dioxide.

Bromoepicamphorcarboxylic acid melts at $148\text{--}150^\circ$, and is decomposed at this temperature with the formation of the same bromoepicamphor (m. p. 134°) as is obtained by the direct bromination of epicamphor (see above).

The investigation of epicamphor is being continued in various directions.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Abderhalden, Emil. [Editor.] Handbuch der biochemischen Arbeitsmethoden. Vol. V. ii. Wien 1912. M. 34.—. (*Reference.*)

From the Publishers: Messrs. Urban & Schwarzenberg.

Bigelow, S. Lawrence. Theoretical and physical chemistry. New York 1912. pp. xiii + 544. ill. \$3 net. (*Recd.* 19/2/12.)

From the Author.

The Chemical World. A monthly journal of chemistry and chemical engineering. Vol. I, No. I, etc. London 1912. ill. Annual subscription 6/-, post free. (*Reference.*)

From the Publishers: Messrs. J. & A. Churchill.

Dyson, S. S., and Clarkson, S. S. Chemical works. Their design, erection, and equipment. London 1912. pp. xii + 207. ill. 21/- net. (*Recd.* 2/3/12.)

From the Publishers: Messrs. Scott, Greenwood & Son.

Institute of Chemistry of Great Britain and Ireland. A list of official chemical appointments compiled, . . . by *Richard B. Pilcher*, 4th edition. London 1912. pp. 246. 2/- net. (*Recd.* 22/2/12.)

From the Institute.

MacDonald, George William. Historical papers on modern explosives. With an introduction by *Sir Andrew Noble*. London 1912. pp. xi + 192. 7/6 net. (*Recd.* 20/2/12.)

From the Author.

MacEwan, Peter. Pharmaceutical Formulas . . . collected chiefly from *The Chemist and Druggist* and *The Chemists' and Druggists' Diaries*. 8th edition. London 1911. pp. xvi + 1040. 10/-.

(*Recd.* 17/2/12.)

From the Author.

Nisbet, Harry. Theory of sizing. Manchester 1912. pp. xi + 75. ill. 2/6 net. (*Recd.* 10/2/12.)

From the Publishers: Messrs. Emmott & Co., Ltd.

II. *By Purchase.*

Beckurts, H., and Lünig, O. Die Methoden der Massanalyse. Part II. Braunschweig 1912. pp. ix + 483 to 842. ill. M. 10.—. (*Recd.* 22/2/12.)

Treadwell, Frederick Pearson. Analytical chemistry. Volume I. Qualitative analysis. Authorised translation from the German by *William T. Hall*. 2nd edition. New York 1911. pp. xi + 469. ill. 17/- net. (*Recd.* 23/2/12.)

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Thursday, March 28th, 1912, at 4.30 p.m., when the President will deliver his address, entitled, "Some Stereochemical Problems."

VAN'T HOFF MEMORIAL.

Subscriptions to the Van't Hoff Memorial Fund should be sent to the Treasurer of the Society (Dr. Alexander Scott, F.R.S.). The sum already promised and received amounts to £44 14s. 0d.

The next Ordinary Scientific Meeting of the Society will be held on Thursday, March 21st, 1912, at 8.30 p.m., when the following papers will be communicated:

"*iso*Erucic acid." By A. K. Macbeth and A. W. Stewart.

"Parahydroxystilbene and its derivatives." By J. T. Hewitt, W. Lewcock, and F. G. Pope.

"The chemistry of the glutaconic acids. Part V. The esters of substituted glutaconic acids." By N. Bland and J. F. Thorpe.

"Syntheses of 3-hydroxy-(1)-thionaphthen." By A. M. Hutchison and S. Smiles.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 28.

No. 399.

Thursday, March 21st, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Mr. W. J. S. Naunton was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Arthur Anderson Bones, 640, Schoeman Street, Pretoria, S. Africa.

Raymond Edwin Crowther, Edenvale, Wigton Road, Carlisle.

William Dallas, Burnbank Cottage, Mount Vernon, Glasgow.

Archibald Knox, 18, Newhall Terrace, Greenhead, Glasgow.

Edwin Charles Lacey, B.Sc., St. Julian's Lodge, West Norwood, S.E.

Leslie Herbert Lampitt, M.Sc., Bowyer Road, Saltley, Birmingham.

Robert John Milbourne, Muxton Lodge, Newport, Salop.

George Walker, Stonehurst, Lancaster Road, Morecambe.

Charles Reginald Wilkins, B.Sc., 40, Church Lane, Hornsey, N.

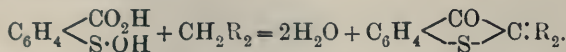
A certificate has been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Mr. John Scott Thomson, Crawford Street, Dunedin, N.Z.

Of the following papers, those marked * were read:

***56. "Syntheses of 3-oxy-(1)-thionaphthen."**

By Archibald Moritz Hutchison and Samuel Smiles.

It was shown that in the presence of concentrated sulphuric acid and chlorosulphonic acid or other similar reagents, *o*-thiol- and *o*-dithio-benzoic acids with malonic acid or ethylacetoacetate yield 3-oxy-(1)-thionaphthen or derivatives thereof. Reasons were given for considering that this reaction is caused by the condensation of the sulphonylic acid (*Trans.*, 1911, **99**, 640) with these methylene derivatives:



It was also pointed out that other examples of this type of interaction are to be found in technical processes for preparing "thioindigo."

***57. "The behaviour of metallic alloys when heated in a vacuum."**

By Clarence Richard Groves and Thomas Turner.

The authors have heated a number of binary alloys in a porcelain boat under a pressure not exceeding 1 mm. of mercury. The boat was contained in a porcelain tube, and heated in an electric resistance furnace to temperatures ranging from 500° to 1200°.

It is concluded that the alloys may be divided into five groups as follows:

(1) *The metals are not appreciably volatile when heated in a vacuum for a moderate time at or below 1200°.*

As examples of this class may be mentioned the alloys of copper with iron, aluminium, tin, or nickel. It may also be assumed that any mixtures of these four metals in any proportions would also be non-volatile.

(2) *The constituent metals are quantitatively separable.*

Thus the alloys of the copper-bismuth, copper-lead, and copper-zinc series all separate at the melting point of copper. The bismuth, lead, or zinc volatilise, whilst pure copper remains. Iron-zinc alloys can be quantitatively separated at 500°.

(3) *Any excess of the more volatile metal is removed, and a chemical compound remains.*

The gold-zinc series yields AuZn; the copper-antimony, Cu₃Sb; the gold-cadmium, AuCd; and the magnesium-zinc, MgZn₂.

(4) *The excess of the more volatile metal is removed, but the residue is not a chemical compound.*

Thus in the copper-arsenic series the arsenic retained diminishes as the temperature rises. At 1200° the composition remains constant with about 20 per cent. of arsenic, which does not correspond with any simple atomic proportions.

(5) *Two (or more) metals may volatilise together.*

Thus lead and zinc tend to pass over together. In the iron-zinc series also there is an increasing proportion of the iron carried over as the temperature rises from 500° . In the silver-zinc series, although separation is nearly quantitative at 700° , there is an increased loss of silver with higher temperatures.

DISCUSSION.

Dr. HODGKINSON inquired if the authors had observed any gas evolution during the process, although he doubted whether that would have been possible owing to the character of the vacuum which had to be maintained against a sealing-wax closure.

His reason for asking was that recently he had melted some very pure electrolytic copper in a silica tube in a Sprengel vacuum, and the evolution of hydrogen had not ceased when the tube cracked after more than twelve hours' heating. The globule of copper was found to be full of large bubbles when cut open after cooling.

The total separation of zinc from copper in brass at 1100° in a vacuum appeared very extraordinary, as some eight or nine years ago he, with Major Howarth, R.A., had made brass of the composition Cu_2Zn by passing zinc vapour, with the aid of a stream of hydrogen, over copper heated to a little over 1000° .

Other metals, such as platinum, nickel, and palladium, also retained definite amounts of zinc in similar circumstances.

Dr. J. F. SPENCER pointed out that Professor Turner's experiments indicated that alloys could be divided into pairs, depending on their behaviour on distillation, which were analogous to the various pairs of completely miscible liquids; thus, for example, with some of the alloys a complete separation was possible, whilst with others one metal distilled away, leaving apparently a definite compound. This supposed compound corresponded exactly with the constant-boiling liquid mixture of minimum vapour pressure. Dr. Spencer asked the author if he had made any experiments to see if the composition of the supposed compound was changed in any way, for example, by change in the pressure under which the distillation was carried out.

Mr. EGERTON drew attention to the construction of the electric resistance furnaces used by Professor Guntz in his work on the

preparation and distillation of metallic barium, and asked Professor Turner whether he had had trouble with the platinum at high temperatures. Another point which had interested him was the mention of the vapour pressure of metals at the ordinary temperature; it was questionable whether a crystalline metal had any vapour pressure below a certain temperature.

Mr. W. P. DREAPER suggested that the results should be extended to 1300° , so that they could be compared with those recently obtained by Sir W. Crookes, where even iridium lost 7 per cent. of its weight on heating for twenty-two hours. If the iron-copper alloys were stable at that temperature, it would be an interesting fact.

Professor TURNER said, in reply to Dr. Hodgkinson, that their experiments showed that the quantity of gas evolved with the relatively small quantities of alloys employed was usually small. When any considerable quantity of gas was evolved, they found that some was occluded in the tube, but practically the whole of this was evolved if the tube were cooled and re-heated. With a second cooling and re-heating, the residue of gas was very small indeed. Porcelain tubes were less permeable to gases at high temperatures than fused silica tubes. It was possible to make brass by heating bright copper in an exhausted glass tube containing zinc at a temperature 50° below the melting point of zinc, or, say, 375° . The platinum in the resistance furnace was in the form of a spiral of thin sheet. It lasted well so long as the temperature did not exceed 1200° , but deteriorated rather rapidly with greater heat. No doubt if some of the alloys examined had been subjected to a higher temperature, different and very interesting results might have been obtained. He hoped someone would carry out such experiments. The separation of metals in a vacuum was usually effected at the melting point of the less fusible metal, but in some cases, as in the zinc-iron series, the alloy was solid throughout the experiment. They had tried various substances for making the joints at the cold ends of the porcelain tube, and had found ordinary red sealing-wax gave the most satisfactory results.

***58. "The oxidation of atmospheric nitrogen in presence of ozone."
By Thomas Martin Lowry.**

When air under the ordinary pressure is driven over a series of spark-gaps a product is obtained which gives an increased yield of nitrogen peroxide if mixed with ozone. It is suggested that this product may contain a chemically active form of nitrogen.

DISCUSSION.

Dr. FEILMANN remarked that it would be comparatively easy to test Dr. Lowry's hypothesis on the formation of active nitrogen by passing pure nitrogen, free from oxygen, over a spark-gap, and then mixing it with ozonised air.

Dr. ROBERTSON stated that in extending the spectroscopic method for the quantitative estimation of nitrogen peroxide to mixtures containing that gas in very low concentrations, he had found it advisable to make the parts of the apparatus of non-reactive substances; thus for strict quantitative work, observation tubes should be made of silica rather than of glass.

***59. "A method of producing a steady thallium flame."**

By Thomas Martin Lowry.

Thallium chloride is vaporised by heating it gently in a silica bulb, and is carried into the flame by a current of oxygen. The oxygen is admitted to the bulb by a horizontal tube, and passes into the flame through a second tube, which terminates in a vertical jet.

***60. "Electro-reduction of alkylnitrosoamides."**

By Hilmar Johannes Backer.

In continuation of previous researches on the electro-reduction of nitroamino-compounds to hydrazines (*Diss.*, Leyden, 1911), the author has studied the reduction of alkylnitrosoamides of common organic acids, which has been unsuccessfully attempted by various investigators.

It was shown that *oxalylbismethylnitrosoamide* (m. p. 66°, decomp.) and *succinylbismethylnitrosoamide* (m. p. 110°, decomp.), when reduced in slightly acid solution with a tinned cathode, yield the corresponding hydrazides, which may be isolated as benzylidene derivatives.

The above-mentioned nitrosoamides, especially that of oxalic acid, are unstable. Their decomposition by alkalis and organic bases was described; in each case diazomethane is formed.

***61. "A model of an asymmetric carbon atom."**

By William Edward Garner.

The author has constructed a model to illustrate the explanation, proposed by Werner ("Lehrbuch der Stereochemie," 1904, 49), of the racemisation of optically active compounds.

The asymmetric carbon atom is represented by a cube, which

is composed of four wooden blocks ($\frac{3}{4}'' \times \frac{3}{4}'' \times 1\frac{3}{4}''$). The blocks are placed vertically, and bolted in a horizontal direction, leaving a space of $\frac{1}{4}''$ between the blocks (Fig. 1). The bolts are placed as near the centre of the model as possible. Fig. 3 gives a cross-section, showing the manner in which the bolts are employed. Four iron rods are attached to the bolts in such a way that they can

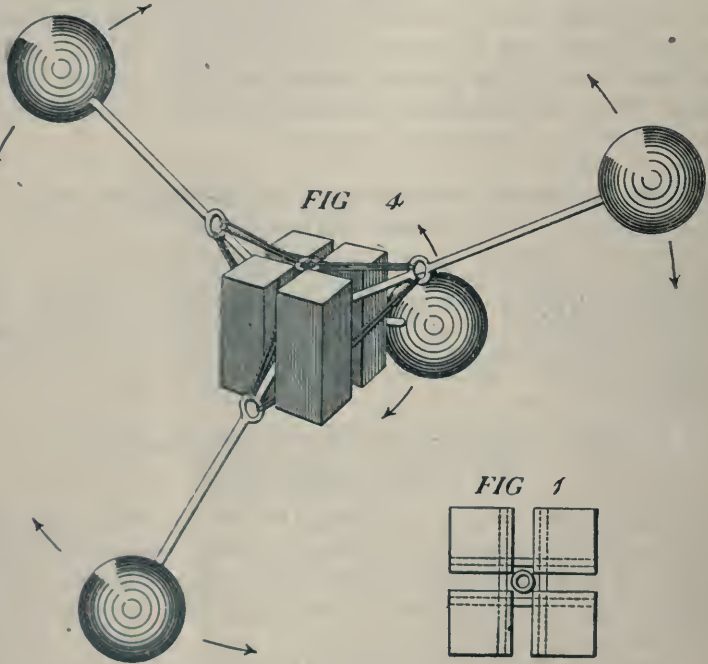


FIG 1

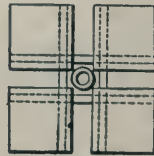


FIG 2

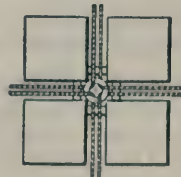
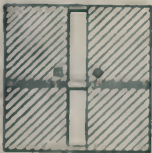


FIG 3



move freely in a vertical direction. Each rod is connected to the two adjacent rods by thin cord, which passes through rings at the top and the bottom of the cube. The method by which this is accomplished may be seen by reference to the diagram (Fig. 2). This represents the top of the cube, but the arrangement of the cords which pass through the lower ring is similar to this if the model be viewed from underneath.

With such a method of attachment, when one arm is vibrated in a vertical direction, all the others move in unison. If one is moved in an upwards direction, then the two adjacent rods will move downwards, whilst that in the opposite position will move upwards (Fig. 4).

Differently coloured balls are attached to the arms, and a model of the asymmetric carbon atom is obtained. If the balls are placed in the order shown in the diagram (Fig. 4), then the arrangement is that of an optically active compound, and if they occupy the vertices of a tetrahedron, the model now illustrates the van't Hoff conception of the asymmetric molecule.

The views of Werner may be illustrated by moving one of the balls up and down, thus causing the other balls to vibrate. This is taken to be the normal condition of the molecule. The application of some external strain, for example, application of heat, causes an increase in the amplitude of the vibration of the groups until all lie in one plane for a small interval of time. This arrangement of the balls is not asymmetric, since a plane of symmetry can be drawn through the carbon atom. Once the balls are in this position there is an equal chance of their returning into their old arrangement or of passing into a new arrangement, which is the mirror image of the first; thus a ball, moving downwards, may continue its movement through the plane of racemisation, and vibrate about a new mean position. This change is similar to that which occurs in the so-called Walden inversion of optically active compounds. Since the new form so produced is transformed with the same facility into the old form, the model gives a method of illustrating Werner's view of racemisation.

The difficulty with which cyclic compounds racemise may be illustrated by tying two opposite arms together, and readjusting the lengths of the strings which control the movement of the arms. It is difficult to bring the other two arms into the plane containing the asymmetric carbon atom, since one of the balls must occupy a position within the ring. For a new arrangement to be formed this ball must pass through the ring, and this is presumably impossible if the group contains several atoms; thus the racemisation of a cyclic compound is practically impossible, unless it can take place through the formation of an intermediate compound.

Whilst the model does not explain the Walden inversion, it is useful in dealing with this process. In the model, only the simplest case can be represented, namely, that in which the amplitude of the vibration of all groups is the same, but this will not interfere with its use for purposes of demonstration.

Another application of the model is to illustrate a possible

explanation of the effect of the solvent on the rotation of an optically active compound. The diminution of the rotation is thus represented by moving the arms nearer to the plane of racemisation, and imparting a motion to them in this new mean position. The model may be used similarly to demonstrate in accordance with the above theory the changes in the rotation of an active compound with temperature.

The readjustment of the strings connecting the arms will serve as a means of altering the valency directions, and so illustrate what may take place when one group is substituted by another. This will alter the direction of the plane of racemisation.

The conversion of fumaric acid into maleic acid may be illustrated by employing two models, in which two adjacent bonds of each are united by short pieces of india-rubber tubing. The groups are then arranged so that the combined model represents either maleic or fumaric acid. If the groups attached to each carbon atom be made to vibrate with the same amplitude, the particular form will be retained; but if the groups attached to one carbon atom be made to pass the plane of racemisation, then the other form is produced.

***62. "Organic derivatives of arsenic and antimony." (Preliminary note.)** By Gilbert T. Morgan and Frances M. G. Micklethwait.

The Grignard reaction carried out with benzyl chloride and antimony trichloride leads to the production of *tribenzylstibine dichloride* (m. p. 105—108°), lustrous crystals, from alcohol; this is hydrolysed to *tribenzylstibine oxide*, which decomposes indefinitely at 240°. Other products of this condensation are being examined.

Comparative experiments with arsenic trichloride and benzyl chloride have shown that the Grignard condensation leads to derivatives of quinquevalent arsenic, from which tribenzylarsine oxide has been obtained.

Antimony trichloride has also been condensed under Grignard conditions with *m*-bromotoluene, *p*-dibromobenzene, *p*-iodonitrobenzene, 4-iodo-1:3-dinitrobenzene, and the three isomeric iodoanilines.

These experiments are being continued with the object of preparing asymmetric organic derivatives of arsenic and antimony suitable for resolution into their optically active components.

63. "*iso*Erucic acid."

By Alexander Killen Macbeth and Alfred Walter Stewart.

In the course of some investigations of absorption spectra, the authors had occasion to purify brassidic acid, two specimens of which were obtained from Schuchardt. This acid was recrystallised

about fifteen times from alcohol, and had a sharp melting point (60°), which remained unchanged by the repeated recrystallisations. On boiling it finally with animal charcoal, the melting point was found to fall to $57-57.2^{\circ}$, and remained constant at this after further recrystallisations. The absorption spectrum of the substance was examined, and found to show slightly less general absorption than either erucic or brassidic acid. Similar results are obtained if crude brassidic is used instead of the purified sample.

An examination of the substance shows that it is unsaturated, as it is easily brominated in aqueous suspension, yielding a bromine derivative (m. p. $46-46.6^{\circ}$). This substance appears to be the dibromide of *isoerucic* acid (m. p. $42-43^{\circ}$), for the dibromide of brassidic acid melts at 54° . *isoErucic* acid itself is stated to melt at $54-56^{\circ}$, so that it appears probable that the substance obtained as described above is *isoerucic* acid in a purer form than has hitherto been produced.

The suggestion has been put forward in the case of oleic acid that the existence of the third isomeride is to be explained by assuming that in *iso-oleic* acid the double bond has been shifted into the α -position with regard to the carboxyl group. If the same idea is applied to *isoerucic* acid, we should expect to find its absorptive power to be greater than either that of brassidic or erucic acids, owing to the presence of a pair of conjugated double bonds in the molecule; but since it has actually less absorption than either of the other isomerides, this explanation of the isomerism cannot be applied to the present case.

It is proposed to examine other cases of the kind with the view of determining whether the method is generally applicable to the preparation of these *iso*-forms.

64. "*p*-Hydroxystilbene and its derivatives."

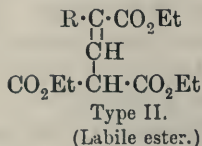
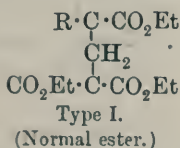
By John Theodore Hewitt, William Lewcock, and Frank George Pope.

The analogy existing between derivatives of azobenzene, benzylideneaniline, and stilbene has been extended by the preparation of 4-hydroxystilbene and its 4'-nitro-derivative, and comparison of their absorption spectra in neutral and alkaline solution with those of stilbene and 4-nitrostilbene. The corresponding methoxy-compounds have also been examined.

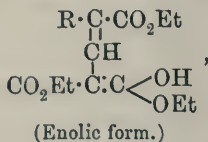
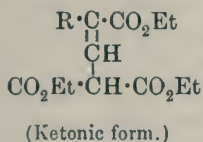
4-Hydroxystilbene is colourless, but shows a strong absorption band in the ultra-violet; a band which is partly in the visible region of the spectrum is shown by the 4'-nitro-derivative. Addition of alkali to the alcoholic solutions of both compounds causes the band to shift towards the red end of the spectrum, but the displacement is considerably greater in the case of nitrohydroxystilbene than in that of hydroxystilbene itself.

65. "The chemistry of the glutaconic acids. Part V. The esters of substituted glutaconic acids." By Norman Bland and Jocelyn Field Thorpe.

It was shown that the esters of substituted glutaconic acids having two negative groups attached to the same carbon atom yield enolic sodium derivatives which dissociate in water to an extent depending on the tendency for the hydrogen atom to pass back into the three-carbon system. The esters formed in this manner are the normal esters of type (I). The undissociated sodium compounds then yield the labile esters (type II) when decomposed by carbon dioxide:



The esters of type II may exist in either their ketonic or enolic forms:



and it was shown that the stability of these forms depends on the nature of R.

Thus when R=methyl, the ketonic form is alone capable of existence in the free state; whereas when R=benzyl, an equilibrium mixture of the two desmotropic individuals is produced.

When a methyl group occupies the β -position and a benzyl group the α -position, tautomerism ceases to be apparent, and the ketonic and enolic forms become structurally distinct.

66. "The viscosity of compounds containing tervalent nitrogen. Part I. The amines." By Albert George Mussell, Ferdinand Bernard Thole, and Albert Ernest Dunstan.

Forty-four amines have been examined in the pure state at 25° and 130°, also in amyl acetate and in hydrochloric acid solution. Viscosities have been expressed in terms of the quantity $(\eta + 10^6)/\text{Mol. vol.}$ The order of increasing viscosity is tertiary, secondary, primary.

Substitution of an alkyl group for hydrogen lowers the molecular viscosity. Substitution of an acyl, phenyl, or benzyl group for

hydrogen increases the molecular viscosity. Substances with a very high value of K have correspondingly high viscosities.

There is a close parallelism between the association constant α and molecular viscosity. Meta-compounds have, in general, lower viscosities than ortho- or para-derivatives. Conjugation of unsaturated groupings increases viscosity, and acts in a similar way on K .

67. "The reciprocal influence of unsaturated centres and its effect on the general absorptive power of compounds." By Alexander Killen Macbeth, Alfred Walter Stewart, and Robert Wright.

From an examination of the absorption spectra of various stereoisomerides, the authors find that if a molecule contains an unsaturated centre U , such as a carboxyl group, and a saturated centre S , such as an alkyl radicle, a variation in the relative spatial positions of S and U produces very little change in the general absorptive power of the molecule. On the other hand, if the molecule contains two unsaturated centres, a change in their relative spatial positions produces a marked alteration in the absorption spectrum; thus erucic and brassidic acids have very similar absorption spectra, whereas the spectra of maleic and fumaric acid differ very considerably from each other. From this the authors deduce that in order to alter the general absorptive power of a molecule it is necessary to change the relative positions of at least two unsaturated centres within the molecule. The action of two centres of unsaturation is also shown by a comparison of the absorption spectra of ammonium thiocyanate and thiocarbamide. In the former there is only one unsaturated centre, namely, the $\cdot\text{CNS}$ -group; whilst in the latter there are two, namely, the amido-radicles. The latter compound has a much greater absorptive power than the former.

68. "Experiments on a yellow colouring matter from ergot." By Albert Freeborn.

It was shown that the three yellow colouring matters hitherto obtained from ergot (sclerocrystallin, ergochrysin, and secalonic acid) are in all probability identical, and have the composition $\text{C}_{21}\text{H}_{22}\text{O}_9$. Another *substance*, crystallising in pale yellow needles, of the composition $\text{C}_{15}\text{H}_{14}\text{O}_7$, and melting at 338° , has now been obtained. It yields a *tetra-acetyl* derivative, $\text{C}_{23}\text{H}_{20}\text{O}_{10}$, melting at 231° , and does not contain methoxyl. On fusion with potassium hydroxide, an unidentified phenolic acid is formed, probably containing at least three phenolic hydroxyl groups.

69. "The density of acetic acid. A correction."

By William Robert Bousfield and Thomas Martin Lowry.

In the paper on acetic acid (Bousfield and Lowry, *Trans.*, 1911, 99, 1439) the difference in the density of acetic acid for 1° was given as 0.00123 instead of 0.00113. This does not affect the data given in the paper, but introduces errors of 0.0001 to 0.0003 in the reduction to 18° of the values given by other observers.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Burgess, G. K., and Le Chatelier, H. The measurement of high temperatures. 3rd edition. New York 1912. pp. xviii + 510. ill. \$4 net. (*Recd.* 15/3/12.)

From the Publishers: Messrs John Wiley & Sons.

Prescriber, The. A monthly journal dealing with therapeutics, pharmacology and the newer remedies. Edited by Thomas Stephenson. Vols. II.-V. Edinburgh 1908-1911. Annual subscription, 5/-, post free. (*Reference.*)

II. *By Purchase.*

Cohnheim, Otto. Chemie der Eiweisskörper. 3rd edition. Braunschweig 1911. pp. xii + 388. M. 12.— (*Recd.* 14/3/12.)

Fraenkel, Sigmund. Die Arzneimittel-Synthese auf Grundlage der Beziehungen zwischen chemischem Aufbau und Wirkung. 3rd edition. Berlin 1912. pp. viii + 823. M. 24.— (*Recd.* 19/3/12.)

Hoff, J. H. van't. See Jorissen, W. P., and Reicher, L. Th.

Jorissen, W. P., and Reicher, L. Th. J. H. van't Hoff's Amsterdamer Periode, 1877-1895. Helder 1912. pp. vi + 106. M. 4.70. (*Recd.* 14/3/12.)

Ostwald, Wilhelm. Outlines of general chemistry. Translated by W. W. Taylor. 3rd edition. London 1912. pp. xvii + 596. 17/- net. (*Recd.* 14/3/12.)

Plotnikow, Johannes. Photochemische Versuchstechnik. Leipzig 1912. pp. xv + 371. ill. M. 11.— (*Recd.* 14/3/12.)

Urbain, G. Introduction à l'étude de la Spectrochimie. Paris 1911. pp. iii + 248. ill. 8/- net. (*Recd.* 14/3/12.)

VAN'T HOFF MEMORIAL.

Subscriptions to the Van't Hoff Memorial Fund should be sent to the Treasurer of the Society (Dr. Alexander Scott, F.R.S.). The sum already received amounts to £60 1s. 0d.

OPTICAL CONVENTION.

In connexion with the Optical Convention and Exhibition of Optical and Allied Industries to be held in the latter half of June, 1912, a Committee is to be formed for the purpose of establishing an effective co-operation between scientific men—the users of optical instruments—and British manufacturers of such instruments. Fellows of the Chemical Society who may be willing to assist this Committee by making known their special wants or their suggestions for the improvement in the design and construction of optical instruments and appliances in which they are interested, can obtain forms from the Honorary Secretaries on which to communicate with the Honorary Secretary of the Optical Convention.

EIGHTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

The Eighth International Congress of Applied Chemistry will be opened by the President of the United States at Washington on September 4th, 1912. Subsequent meetings will be held in New York from September 6th to 13th. During the week, members will be entertained, and, afterwards, visits will be made to factories and other places of interest in the United States and in parts of Canada. The attention of visitors to the Congress is particularly called to the following dates:

May 15th, 1912: All who desire to take part in the Yellowstone Park Tour must have their notification in the hands of the American Committee.

June 1st, 1912: Reservations on the S.S. *Cleveland* and *Philadelphia* remaining unsold at this date to members of the Congress will be disposed of as the Executive Committee may decide.

June 15th, 1912: All persons desiring to take part in any tour apart from the Yellowstone Park Tour must have their notification in the hands of the American Committee.

June 30th, 1912: All papers that authors expect to have printed and distributed at the time of the Congress must be in the hands of the American Committee.

July 15th, 1912: All memberships received after this date by the American Committee are accepted on the condition that delivery of printed reports cannot be *guaranteed* to such members.

Rules, and Announcement No. 3, containing general information, programme, details of excursions, etc., with forms of application for membership, may be obtained from Mr. C. G. Cresswell, Society of Chemical Industry, Palace Chambers, Westminster, S.W. Membership tickets, price £1 each, can be obtained from Dr. M. O. Forster, F.R.S., *Treasurer of the British Organising Committee*, 84, Cornwall Gardens, S.W.

The next Ordinary Scientific Meeting of the Society will be held on **Thursday, April 18th, 1912, at 8.30 p.m.**

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 28.

No. 400.

Thursday, March 25th, 1912, ANNUAL GENERAL MEETING, Prof. PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Professor A. G. GREEN and Dr. G. SENTER were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The Report of the Council on the progress of the Society during the past twelve months was presented by the PRESIDENT; and the TREASURER made a statement as to the Society's Income and Expenditure for 1911. After some remarks with reference to the awarding of Grants from the Research Fund of the Society made by Mr. John Hughes, the Adoption of the Report of the Council, together with the Balance Sheet and Statements of Accounts for the year ended December 31st, 1911, proposed by Professor E. J. MILLS and seconded by Dr. A. HARDEN, was carried unanimously.

A Vote of Thanks to the Auditors was proposed by the TREASURER and seconded by Mr. W. MACNAB.

REPORT OF THE COUNCIL.

On the 31st December, 1910, the number of Fellows was 3,073. During 1911, 136 Fellows were elected, and 2 have been reinstated, the gross total being 3,211. The Society has lost 31 Fellows by death; 37 have resigned; the elections of 3 Fellows have become void; 1 Fellow has been elected an Honorary and Foreign Member, and 35 have been removed for non-payment of annual subscriptions.

The total number of Fellows, therefore, on the 31st December, 1911, was 3,104, showing a net increase of 31 over the preceding year. For the past six years the average number of newly-elected Fellows has been 163, whilst the average increase in membership

has been over 60. This year the marked falling off in the number of new Fellows accounts for the small net increase.

The names of the deceased Fellows, with the dates of their election, are:

John Attfield (1862).	Isidore Bernadotte Lyon (1873).
Edward Beanes (1864).	William McCowan (1875).
Frederic Braby (1869).	Mervyn Herbert Nevil Story
Joseph Brown (1882).	Maskelyne (1851).
Carl von Buch (1877).	John Muter (1870).
Edward Collens (1873).	Ralph Henry Christopher Nevile
Albert Cooper (1889).	(1878).
John Arthur Cunningham	Temple Augustus Orme (1869).
(1907).	Lewis Buttle Ross (1870).
Stephen Darby (1852).	Sir Samuel Alexander Sadler
Richard Hayton Davis (1872).	(1868).
John Greig Ferrier (1905).	James Sharp (1885).
James Forbes (1874).	Harry Wood Smith (1890).
Albert Harrison (1888).	James Samuel Hourston Walker
Alfred Henry Hoit (1904).	(1890).
William Hudson (1878).	William Whitehouse (1889).
Leonard Parker Kinnicutt	William Williams (1892).
(1895).	William George Winterson
Frederick Charles Knight (1889).	(1908).

The following Fellows have resigned:

Francis Paul Armitage.	Victor George Jackson.
William Henry Benson Baker.	Edwin Charles Jee.
George Russell Beardmore.	Rudolph Lyon.
William Arthur Colebourn.	William James McKerrow.
George Hugh Crisp.	Edward Handfield Morton.
Middleton Henry Dand.	Alan Edward Munby.
Francis Bridger Dutton.	Cyril Lawrence Norman.
Walter Nicholas Edwards.	Georges Ponthieu.
Walter John Elliott.	Harry James Powell.
Bernard Scott Evans.	James Proude.
Joseph Valentine Francies.	James Bertram Russell.
John Lawrence van Geyzel.	Henry Stanley Shelton.
Archibald Melville Glass.	Charles Joseph Smith.
Herbert Grime.	Brenton Symons.
William Peer Groves.	Harold Munkman Timpany.
Archie Cecil Osborn Hann.	Gustave Arthur Troye.
Sydney Walters Harris.	John Watson.
John Ansted Harrison.	George Edward Welch.
Arthur Edwin Hill.	

The following Fellow has been elected an Honorary and Foreign Member:

John William Mallet.

The following Fellows have been reinstated by the Council, in accordance with Bye-law IV:

Robert Drysdale MacKechnie.

James Bertram Russell.

The Council will be glad to receive information as to the present address of the following Life Fellows who have not answered the inquiries made in the usual manner: J. Bayne, G. W. Davey, and J. Parkinson.

The question of the misuse of the letters "F.C.S." has again been considered by the Council, and opinion of Counsel has now been received that a person using the letters "F.C.S." without authority and for the purpose of assuming wrongfully the status of a Fellow of the Chemical Society, can be restrained by injunction from so doing.

At the end of 1910 the number of Honorary and Foreign Members was 30. During 1911 the Society has had to mourn the loss of J. H. Van't Hoff, A. Ladenburg, Walthère Spring, and L. J. Troost; whilst on March 2nd E. Bamberger, G. Ciamician, P. H. Ritter von Groth, J. W. Mallet, and W. Nernst were elected. The number of Honorary and Foreign Members at the end of 1911, therefore, was 31.

The Council has great pleasure in offering its hearty congratulations to Mr. Edward Riley, who completed his sixtieth year of Fellowship on December 15th, and to the following, who, during the past year, attained their Jubilee as Fellows:

Major Charles Edward Beadnell, R.A.

Mr. Henry Owen Huskisson.

Mr. Frederick Norrington.

During the year, 342 scientific communications were made to the Society, 265 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1911 contains 2,371 pages, of which 2,270 are occupied by 259 memoirs, the remaining 101 pages being devoted to the Obituary Notices, the Faraday Lecture, the Berthelot Memorial Lecture, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 270 memoirs which occupy 2,601 pages.

The Journal for 1911 contains 5,236 abstracts, which extend to 2,200 pages, whilst the abstracts for 1910 numbered 4,867, and occupied 2,032 pages. The abstracts may be classified as follows:

PART I.

	Pages.	No. of Abstracts.
Organic Chemistry	1,056	1,785

PART II.

General and Physical Chemistry		1,097
Inorganic Chemistry		489
Mineralogical Chemistry		136
Physiological Chemistry		717
Chemistry of Vegetable Physiology and Agriculture		343
Analytical Chemistry		669
	1,144	3,451
Total in Parts I. and II.	2,200	5,236

The attention of Authors is drawn to the notice printed on the cover of the Journal regarding extra copies of papers. This notice now reads:

"7. If Authors require more than the 50 reprints allowed by the Society, they should inform the Editor at the time they send in their corrected proofs, when the extra copies will be supplied at rates which can be obtained from the Printers."

The Transactions for 1911 contain obituary notices of Beilstein, Erlenmeyer, Fittig, Landolt, and Menschutkin, accompanied by a portrait of each of these eminent Honorary and Foreign Members. Obituary notices appear, also, of R. Abegg, J. Campbell Brown, Michael Carteghe, O. Guttman, Sir Walter Palmer, Bart., and C. H. Greville Williams, and the Council expresses its thanks to those gentlemen who have so kindly prepared these notices.

The Faraday Lecture was delivered in the Lecture Theatre of the Royal Institution (by the courtesy of the Managers) on June 14th, by Professor Theodore W. Richards, who took as the subject of his discourse, "The fundamental properties of the elements." The lecture was published in the Transactions for June, and an account of the speeches made at the close of the lecture will be found in the Proceedings (p. 177 *et seq.*).

On November 23rd the Society had the privilege of listening

to an account of the life and work of Berthelot from Professor Harold B. Dixon.

Sir Oliver Lodge has kindly consented to deliver the Becquerel Memorial Lecture in the place of Professor Rutherford. The Berthelot and Becquerel Lectures, together with those in honour of Moissan and Cannizzaro, may enable the Council to arrange for the publication of a second volume of Memorial Lectures.

The number of Fellows elected during the early years of the Society's existence has been still further diminished by the death of Nevil Story Maskelyne, elected on June 2nd, 1851, Stephen Darby, elected on November 15th, 1852, and John Attfield, elected on January 16th, 1862. The Society was represented by Sir William Tilden and Professor Crossley at the funeral of Dr. Attfield, and by Dr. Hugo Müller at that of Dr. Nevil Story Maskelyne.

The Council has received a portrait of Dr. John Jeffries presented by Mr. G. H. Gabb, and a portrait of Professor Adolf von Baeyer, presented by the Society of Dyers and Colourists. The best thanks of the Council have been accorded for these gifts, and for a generous bequest of a number of chemical works of historical interest, of which the Library contained no copy, from the family of the late Dr. W. J. Russell.

On the occasion of the Coronation of His Majesty King George V. the Council presented a Loyal Address of Congratulation (Proc., p. 184). The Society co-operated with the other Societies in Burlington House in decorating and illuminating the building during the Coronation festivities.

An address was presented to the Royal Academy of Sciences of Turin on the occasion of the Centenary Commemoration of Amedeo Avogadro (Proc., p. 272). The Society has received from the Academy a copy of the Avogadro Medal which has been placed in the cabinet in the Library.

At the celebration of the 500th Anniversary of the Foundation of the University of St. Andrews, the Society entrusted to Sir William Tilden the presentation of an address of congratulation (Proc., p. 185).

Prof. R. Meldola and Sir William Ramsay have been nominated to represent the Society on the Council of the International Coal Smoke Abatement Exhibition to be held in London in April, 1912, and Prof. J. B. Cohen, Prof. H. B. Dixon, and Prof. A. Smithells attended on behalf of the Society the Conference of the Smoke Abatement League of Great Britain, held in Manchester in November.

The Council desires to record its appreciation of the valuable

services rendered to the Society by Professor G. T. Morgan, who, owing to his appointment to the Chair of Chemistry at the Royal College of Science, Dublin, retires from the position of Honorary Secretary, which he has held for two years.

The general invitation to the Society to attend the meetings of the Eighth International Congress of Applied Chemistry to be held in Washington and New York in September, 1912, has been accepted by the Council on behalf of the Society. Further particulars of the Congress will be announced.

The Council considered a suggestion made by Professor Hofmann and Professor Ruff at the request of the German Chemical Society, for the subdivision of the section of Inorganic Chemistry at the Eighth International Congress of Applied Chemistry, and resolved that: "In the opinion of the Council of the Chemical Society, the object of the International Congress of Applied Chemistry is to bring together persons whose interests do not exactly follow the same lines; and they consider that too much subdivision of the various Sections will defeat one of the objects for which the Congress was instituted. The Council, therefore, on general grounds, cannot support the proposal made by Professor Hofmann and Professor Ruff for consideration by the German Chemical Society."

An International Committee has been formed for the purpose of raising a memorial to the late Prof. J. H. van't Hoff, and the Treasurer will be glad to receive donations from Fellows to this fund.

The Longstaff Medal for 1912 has been awarded to Dr. H. Brereton Baker, and the formal presentation of the medal will be made at the Annual General Meeting.

The Council has made a donation of £10 to the International Commission of Publication of Annual Tables of Constants and Numerical Data, Chemical, Physical, and Technological.

During 1911, 1,808 books were borrowed from the Library, as against 1,918 in 1910; of these 419 were issued by post, as compared with 573 in the previous year.

The additions to the Library comprise: 171 books, 104 of which were presented, 438 periodicals (representing 237 Journals), and 87 pamphlets, compared with 163 books, 431 volumes of periodicals (representing 236 Journals), and 141 pamphlets last year.

These figures show a decrease of 110 in the number of books borrowed, and 54 in the number of pamphlets; whilst there is an increase of 8 in the books added, and 7 in the number of periodicals.

With the object of keeping the Library as up-to-date and repre-

sentative as possible, the Council will especially welcome the gifts of works written by Fellows of the Society.

A year ago attention was called to the fact that the expenditure for 1910 had exceeded the income by £147, but that this could be traced to several causes acting simultaneously.

In spite of the notably smaller number of new Fellows elected and the consequent diminution in receipts from admission fees, the income for the year which has closed exceeds the expenditure by £235 17s. 8d., which is more than enough to compensate for the adverse balance of the previous year. The income from all sources for 1911 amounts to £7,735 11s. 6d., and the total expenditure to £7,499 13s. 10d., the corresponding amounts for 1910 being £7,447 5s. 10d. and £7,594 12s. 2d. respectively. Whilst the receipts have thus increased by £288 5s. 8d., the expenditure has been reduced by £94 18s. 4d., and this has been attained without diminishing in any way the activity and efficiency of the Society.

The Journal is a little smaller in bulk, and has cost about £30 less for printing. Our bill for "corrections" (always a very unsatisfactory and debatable item in our printers' accounts) and the average cost per page for this, grows steadily less owing to the strenuous care of the Editor, aided by the cordial co-operation of the great majority of authors with the Publication Committee and compliance with its suggestions. The exercise of greater care in the preparation of manuscript, the adoption of more concise expression, and the elimination of unnecessary experimental details would very considerably reduce the cost of the Journal, with great advantage to author and reader alike. For 1911 the cost of the Journal was £5,237 13s. 7d., as against £5,177 7s. 8d. for 1910, an increase of only £60 5s. 11d. Of this, £44 10s. 0d. is due to an increase in the amount of abstractors' fees, an item paid as "piece work," for which the Society most certainly gets its full value, and the Council takes this opportunity of recording its sense of indebtedness to the abstractors for their important services. In almost all other departments economies have been effected as compared with last year; on other publications about £12, the Library £17, miscellaneous expenses, £8, and administrative expenses £118. These decreases amount in all to £180 17s. 5d., and the increases to £85 19s. 1d., resulting in the net diminution of expenditure stated above.

The increased profit resulting from the management of the advertisements by the Society's officers has fully justified the changes made in this department more than a year ago, since the net gain to the Society from this source is about £110, as against £75 for

INCOME AND EXPENDITURE ACCOUNT

		Income.		£	s.	d.	£	s.	d.
To Life Compositions				302	0	0
„ Admission Fees				596	0	0
„ Annual Subscriptions—									
Received in advance, on account of 1911	301	0	0			
„ during 1911	4281	0	0			
„ „ „ 1910	374	0	0			
„ „ „ 1908-9	7	0	0			
„ „ „ Anonymous subscription for 1910	2	0	0			
				4965	0	0			
Less amount included in last year's Income, being valuation of Arrears as per last Balance Sheet	370	0	0			
				4595	0	0			
Add Arrears at date: 1911 £486; 1910 £20; 1909 £6, 1908 £1, estimated to realise as per Balance Sheet	360	0	0			
							4955	0	0
„ Lately Subscribers				4	10	0
„ Investments:—									
Dividends on £6780 Metropolitan Consolidated 3½ per cent. Stock	221	16	4			
„ £1050 London and North Western Railway 3 per cent. Debenture Stock	29	13	2			
„ £1520 14s. 3d. Cardiff Corporation 3 per cent. Stock	42	19	4			
„ £1400 India 2½ per cent. Stock	32	19	4			
„ £2400 Bristol Corporation 2½ per cent. Debenture Stock	56	10	0			
„ £4841 Midland Railway 2½ per cent. Preference Stock	102	3	10			
„ £1200 Leeds Corporation 3 per cent. Stock	33	18	0			
„ £1500 Transvaal 3 per cent. Guaranteed Stock, 1923/53	42	7	6			
„ £1200 North British Railway 3 per cent. Debenture Stock	33	18	0			
„ £700 Canada 3½ per cent. Stock 1930/50	23	1	6			
Income Tax Recovered	30	13	5			
„ Interest on Deposit Account	13	3	1			
							663	3	6
„ Publications:—									
Sales:									
Journals	904	1	11			
Proceedings	30	10	2			
General Index	26	3	0			
Library Catalogue	1	13	8			
Atomic Weight Tables	0	8	3			
Annual Reports on the Progress of Chemistry	152	11	0			
				1115	7	7			
Less Publishers' Commission	106	9	2			
				1008	18	5			
Proceeds of Advertisements in Journal	£184	12	2			
Less Commission	9	16	3			
				174	15	11			
							1183	14	4
„ Sale of Waste-paper, old Ballot Boxes, etc.				3	7	2
„ Subscriptions from other Societies:—									
Society of Chemical Industry	8	8	0			
Society of Public Analysts	10	10	0			
Optical Society	8	8	0			
Optical Convention	0	10	6			
							27	16	6
							£7735	11	6

I have examined the above Accounts with the Books and Vouchers of the Society, and the Investments.

23, QUEEN VICTORIA STREET,
LONDON, E.C.
18th March, 1912

W. B. KEEN,
Chartered Accountant.

FOR THE YEAR ENDED 31ST DECEMBER, 1911.

Expenditure.

	£	s.	d.	£	s.	d.
By Expenses on account of Journal and Proceedings:—						
Salary of Editor, including Indexing	570	0	0			
Salary of Sub-Editor	200	0	0			
Editorial Postages	25	9	9			
Abstractors' Fees	529	15	10			
Printing of Journal	2849	6	0			
Illustrations	9	9	10			
Banding	59	13	11			
Printing of Advertisements	65	13	0			
Wrappers and Addressing	122	6	10			
Distribution of Journal	598	4	0			
Authors' Copies	201	10	2			
Insurance of Stock at Clay's	6	4	3			
				5237	13	7
Printing of Proceedings	219	6	3			
Banding	8	11	7			
Distribution	34	17	6			
				264	15	4
„ Annual Reports on the Progress of Chemistry				416	6	8
„ Purchase of back numbers of Journal				3	4	0
„ List of Fellows				69	10	0
„ Faraday Lecture:—						
Honarium and Expenses				30	6	6
„ Library Expenses:—						
Salary of Librarian and Assistant... ..	180	16	0			
Books and Periodicals	229	7	1			
Binding	42	3	2			
Bookcases	12	2	0			
				464	8	3
„ Indexing for International Catalogue				30	0	0
„ Coronation Illuminations				10	10	0
„ Portraits of Past Presidents				32	11	0
„ Donation to International Commission for Publication of Physico-Chemical Tables... ..				10	0	0
„ Administrative Expenses:—						
Salary of Assistant Secretary	280	0	0			
Salary of Office Assistant... ..	83	0	4			
Wages (Commissionaire, Housekeeper, and Charwoman)	156	8	0			
Coal and Lighting	37	16	10			
House Expenses and Repairs	86	15	11			
Tea Expenses	23	8	11			
Insurances	11	8	3			
Accountants' Charges	21	0	0			
Commission on Recovery of Income Tax	1	10	8			
Printing	104	3	10			
Stationery	34	10	8			
Illuminated Addresses	8	9	6			
Postages	103	8	9			
Miscellaneous Expenses	18	6	10			
				930	8	6
„ Balance, being excess of Income over Expenditure, carried to Balance Sheet				235	17	8

£7735 11 6

certify them to be in accordance therewith. I have also verified the Balance at the Bankers

Approved—

FREDERICK B. POWER,
JOHN M. THOMSON,
SAMUEL RIDEAL,

BALANCE SHEET.—THE CHEMICAL SOCIETY, 31ST DECEMBER, 1911.

Liabilities.

	£	s.	d.	£	s.	d.
To Subscriptions received in advance	239	0	0			
" Cash received on Account of Annual Reports, Vol VIII. (not published)	28	7	7			
" Sundry Creditors	1469	17	0			
" Research Fund :— As per last Balance Sheet	10505	1	9			
Less Excess of Expenditure over Income for the year	8	12	8			
	10496	9	1			
	12239	13	8			
" Chemical Society : Excess of Assets over Liabilities :— As per last Balance Sheet... ..	20157	10	1			
Add Excess of Income over Expenditure for the year	235	17	8			
	20393	7	9			

£32626 1 5

Assets.

	£	s.	d.	£	s.	d.
By Investments (value when acquired) :— £6730 Metropolitan Consolidated 3½ per cent. Stock	7212	8	6			
£1050 London and North Western Railway 3 per cent. Debenture Stock	839	12	0			
£1520 India 3d. Gaslight Corporation 3 per cent. Stock	1650	0	0			
£1400 India 2½ per cent. Stock	1316	1	0			
£2400 Bristol Corporation 2½ per cent. Debenture Stock	3070	2	0			
£4341 Midland Railway 2½ per cent. Preference Stock	3572	2	5			
£1290 Leeds Corporation 3 per cent. Stock	1143	1	0			
£1500 Transvaal 3 per cent. Guaranteed Stock, 1923/53	1460	13	6			
£1200 North British Railway 3 per cent. Debenture Stock	1033	11	0			
£700 Canada 3½ per cent. Stock, 1930/50	704	8	6			
	21001	19	11			

(Estimated present value of Investments,

£18301 0s. 6d.)

" Sundry Debtors :— Optical Society	1	11	6			
Advertising Accounts	66	16	2			
Messrs. Gurney & Jackson	454	18	3			
Telephone Deposit	1	0	0			
" Subscriptions in Arrear, £513. Estimated to realise ..				524	5	11
" Insurances paid in advance	250	0	0	360	0	0
" Cash at Bank on Deposit Account	21	1	5	56	11	4
" Cash in hand						
" Less Overdraft on Current Account	271	1	5			
" Research Fund :— Investments (value when acquired) :— £1000 North British Railway 4 per cent. No. 1	84	6	3			
Preference Stock	1010	0	0			
£4400 Metropolitan Consolidated 3½ per cent. Stock	4587	18	0			
£1034 Great Western Railway 2½ per cent. Debenture Stock	1049	15	11			
£1142 16s. New South Wales 3 per cent. Stock	1000	0	0			
£1122 Metropolitan Water Board 3 per cent. "B" Stock	1002	16	9			
£1365 Midland Railway 2½ per cent. Debenture Stock	1010	0	9			
£806 Victoria 3 per cent. Stock	706	6	2			
	10366	17	7			

(Estimated present value of Research Fund Investments, £9659 12s. 8d.)

" Cash at Bank	129	11	6			
	10496	9	1			

£32626 1 5

RESEARCH FUND INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST DECEMBER, 1911

Income.		£ s. d.		£ s. d.		By Grants to—		£ s. d.		Expenditure.		£ s. d.	
To Dividends on:—													
£1000 North British Railway 4 per cent. No. 1 Preference Stock		37 13 4				E. C. C. Baly...		10 0 0		Brought forward—199 0 0			
£4400 Metropolitan Consolidated 3½ per cent. Stock		145 0 4				T. Q. Chou ...		8 0 0		A. T. Cameron ...		5 0 0	
£1034 Great Western Railway 2½ per cent. Debenture Stock		24 6 10				C. H. Hampshire...		3 0 0		A. Campton ...		10 0 0	
£1142 16s. New South Wales 3 per cent. Stock		32 5 10				T. P. Hilditch ...		10 0 0		D. Cardwell ...		10 0 0	
£1122 Metropolitan Water Board 3 per cent. "B" Stock		31 14 0				E. Hope ...		10 0 0		F. W. Coton ...		5 0 0	
£1365 Midland Railway 2½ per cent. "B" Stock		32 2 8				T. E. Hull ...		10 0 0		F. D. Chattaway ...		10 0 0	
£806 Victoria 3 per cent. Stock		22 15 4		325 18 4		T. C. James ...		5 0 0		A. Clayton ...		10 0 0	
Repayments of Research Grants:—						J. Kenner ...		5 0 0		Miss G. Cliffe ...		5 0 0	
A. T. Cameron		5 8 7				F. R. Lankshear ...		12 0 0		H. M. Dawson ...		10 0 0	
H. McCombie		5 0 0				T. M. Lowry ...		10 0 0		C. Dorée ...		5 0 0	
F. D. Chattaway		12 2 2				J. W. McBain ...		10 0 0		A. C. Dunningham		7 0 0	
A. E. Dunstan		4 6 6				J. E. Myers ...		5 0 0		J. Ferns ...		10 0 0	
F. B. Thole		5 5 0				W. Parry ...		10 0 0		R. T. Hardman		10 0 0	
G. Dean		5 8 7				R. Robinson ...		5 0 0		E. Hope ...		15 0 0	
V. H. Veley		4 4 7				R. E. Slade ...		5 0 0		A. Hopwood ...		10 0 0	
G. Senter		5 2 6				Miss I. Smedley ...		10 0 0		T. E. Hull ...		12 10 0	
A. Clayton		4 4 7				F. B. Thole ...		5 0 0		J. W. McDavid ...		10 0 0	
W. W. Close		5 0 0				H. T. Tizard ...		8 0 0		A. N. Meldrum ...		5 0 0	
W. Godden		2 9 7				W. E. S. Turner ...		8 0 0		R. S. Pollard ...		10 0 0	
A. Lapworth		10 0 0				D. Tyrer ...		12 0 0		J. N. Pring ...		15 0 0	
						O. L. Brady ...		10 0 0		W. M. Roberts ...		15 0 0	
						Carried forward—199 0 0				D. Segaller ...		393 10 0	
Income Tax Recovered		43 16 8				Commission on Recovery of Income Tax						1 0 2	
Balance, being Excess of Expenditure over Income carried to Balance Sheet		20 3 6				Advertisements						3 13 0	
		8 12 6				Cheque Book						8 0	

1910, and £10 in 1909. This is largely due to the energy of Mr. Carr, and to the loyal support given by the Fellows of the Society and other advertisers.

The net income from the investments in the name of the Research Fund amounts to £345 1s. 8d., and this, together with returned grants to the extent of £43 16s. 8d., made the income available for distribution amongst applicants £388 18s. 4d., and as there was a balance in hand, the Council was enabled to distribute a sum of £393 10s. 0d. in forty-two grants, which varied in amount from £3 to £25.

ADDENDUM.

INTERNATIONAL ASSOCIATION OF CHEMICAL SOCIETIES.

As mentioned in the Proceedings (p. 132 *et seq.*), meetings of the delegates appointed by the French, English, and German Chemical Societies took place in Paris on the 25th and 26th April last, at which the statutes of the Association were drafted, and subsequently ratified by the Councils of the three Chemical Societies responsible for the foundation of the Association. These statutes are printed in full in the Proceedings. They may, however, be briefly summarised as follows:

The object of the Association is to form a bond of union between the several Chemical Societies of the world for the purpose of taking into consideration such matters as are of general and international interest to Chemistry.

All Chemical Societies are eligible to join the Association. The Association is under the direction of a Council consisting of a certain number of members, and each Country can only be represented on the Council by a single Chemical Society, which shall nominate three representatives.

Thus the Council constituted at the Paris Conference consisted of Profs. Béhal, Haller, and Hanriot (French Chemical Society), Profs. Frankland and Meldola, and Sir Wm. Ramsay (Chemical Society), and Profs. Jacobson, Ostwald, and Wichelhaus (German Chemical Society).

The admission of representatives of any Chemical Society is subject to election by a two-thirds majority of the Council.

At the present moment the Council has the following composition:

German Chemical Society:

Prof. W. Ostwald (President of the Association for the ensuing session, 1912), Prof. H. Wichelhaus (Vice-President), Prof. P. Jacobson (General Secretary).

The Chemical Society:

Prof. P. F. Frankland, Prof. R. Meldola (retired),* Prof.
Sir Wm. Ramsay.

French Chemical Society:

Prof. Béhal, Prof. Haller, Prof. Hanriot.

Italian Chemical Society:

Prof. G. Carrara, Prof. A. Ogialoro, Prof. E. Paternò.

Russian Chemical Society:

Prof. N. S. Kurnakow, Prof. L. A. Tschugaeff, Prof. P. J.
Walden.

American Chemical Society:

Dr. A. L. Day, Prof. W. A. Noyes, Prof. Th. W. Richards.

Swiss Chemical Society:

Prof. F. Fichter, Prof. Ph. A. Guye, Prof. A. Werner.

The following Societies have also joined the Association, but are
as yet unrepresented on the Council:

Nederlandsche Chemische Vereeniging.

Polyteknisk Forenings Kemikergruppe (Christiania).

Verein Oesterreichischer Chemiker (Vienna).

Kemisk Forening (Copenhagen).

At the Paris Conference it was resolved that the first work of
the Association should be the appointment of Committees in each
country, to whom should be entrusted the duty of drafting reports
on each of the three subjects:

(a) Nomenclature of inorganic chemistry.

(b) Nomenclature of organic chemistry.

(c) Unification of the methods of notation of physical constants.

The following Committees have been appointed by the Council
of the Chemical Society:

Inorganic Nomenclature.

Sir Wm. Ramsay (Chairman).
Dr. J. C. Cain.
Dr. A. Harden.

Organic Nomenclature.

Prof. W. P. Wynne (Chairman).
Dr. J. C. Cain.
Prof. F. S. Kipping.

Physical Constants.

Dr. N. T. M. Wilsmore (Chairman).
Dr. J. C. Cain.
Prof. A. Findlay.

* Prof. Arthur W. Crossley has been appointed by the Council of the Chemical
Society to fill the vacancy caused by the retirement of Prof. Meldola.

These Committees, as well as the corresponding ones appointed by the several foreign Chemical Societies, have already sent in reports which will form the subject of discussion by the Council of the Association at their next sessions, commencing on April 11th in Berlin.

A Vote of Thanks to the Treasurer, Hon. Secretaries, Foreign Secretary, and Council for their services during the past year was proposed by Professor H. McLEOD, seconded by Mr. S. P. U. PICKERING, and acknowledged by Professor J. N. COLLIE.

In presenting the Longstaff Medal for 1912 to Dr. H. BRERETON BAKER, the PRESIDENT said:

"Dr. Brereton Baker,—It is my pleasant duty, on behalf of the Society, to make the Presentation of the Longstaff Medal, which has been awarded to you by the Council in recognition of your long-continued, faithful, and brilliant services to Chemical Science.

"Your numerous and remarkable researches on the inactivity of dry gases which culminated in the wonderful discovery that carefully dried oxygen and hydrogen can be heated to the temperature of molten silver without explosion, are of such fundamental importance that an account of them finds a place in the teaching which is imparted even to most elementary students of chemistry, whilst the explanation of your results still baffles all but those who delight in daring speculations.

"You have not, however, restricted yourself to the exploitation of this field in which your skilled labour has turned up so many treasures; but, undaunted by the failure of others, you have directed your attention to the study of the eccentric element tellurium, and have embarked with your great experimental resources on an inquiry into the much-discussed question of its purity. Although in this emprise you have failed to convict tellurium of being contaminated by any subtle attachment, for you have not shaken the accepted atomic weight of this element, yet the undertaking was distinguished by the care, the skill, and the thoroughness which we have learnt to associate with all your work.

"In handing you this medal I would take the opportunity of offering you my personal congratulations, as well as those of the Society, on your recent appointment to the Chair of Chemistry in the Imperial College of Science and Technology, and I would express the earnest hope that you may there, as the successor to Sir William Tilden and to Sir Edward Thorpe, find a congenial atmosphere in which to further prosecute your important researches."

The PRESIDENT then delivered his address, entitled, "Some Stereochemical Problems." Professor R. MELDOLA proposed a vote of thanks to the President, coupled with the request that he would allow his Address to be printed in the Transactions. The motion was seconded by Professor J. J. DOBBIE, and carried with acclamation, the PRESIDENT making acknowledgment.

The Report of the Scrutators was presented, and the PRESIDENT declared that the following had been elected as Officers and Council for the ensuing year:

President: Percy F. Frankland, Ph.D., LL.D., F.R.S.

Vice-Presidents who have filled the Office of President: H. E. Armstrong, Ph.D., LL.D., F.R.S.; A. Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, O.M., D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; Harold B. Dixon, M.A., Ph.D., F.R.S.; A. G. Vernon Harcourt, M.A., D.C.L., F.R.S.; R. Meldola, D.Sc., LL.D., F.R.S.; H. Müller, Ph.D., LL.D., F.R.S.; William Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; J. Emerson Reynolds, Sc.D., M.D., F.R.S.; the Rt. Hon. Sir Henry E. Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William A. Tilden, D.Sc., F.R.S.

Vice-Presidents: G. T. Beilby, LL.D., F.R.S.; M. O. Forster, D.Sc., Ph.D., F.R.S.; A. Liversidge, LL.D., F.R.S.; E. J. Mills, D.Sc., LL.D., F.R.S.; G. T. Morgan, D.Sc.; W. J. Pope, M.A., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: Arthur W. Crossley, D.Sc., Ph.D., F.R.S.; S. Smiles, D.Sc.

Foreign Secretary: Horace T. Brown, LL.D., F.R.S.

Ordinary Members of Council: W. A. Bone, D.Sc., Ph.D., F.R.S.; W. R. Bousfield, M.A., K.C.; Adrian J. Brown, M.Sc., F.R.S.; H. G. Colman, D.Sc., Ph.D.; A. Harden, D.Sc., Ph.D., F.R.S.; A. R. Ling; T. M. Lowry, D.Sc.; A. McKenzie, D.Sc., Ph.D.; H. Marshall, D.Sc., F.R.S.; J. C. Philip, D.Sc., Ph.D.; Sir Boverton Redwood, Bart., D.Sc.; E. J. Russell, D.Sc.

Thursday, April 18th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss the Society had sustained by the deaths of Dr. Edward Divers, F.R.S., and Mr. John Pattinson, who had served on the Council and as Vice-Presidents of the Society.

It was announced that the following Committees for 1912-1913 had been appointed by the Council:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William Tilden, and the Officers.

House Committee: Messrs. W. R. Dunstan, R. Messel, J. E. Reynolds, J. M. Thomson, Sir Edward Thorpe, Sir William Tilden, and the Officers.

Library Committee: Messrs. B. Dyer, W. Gowland, A. Harden, J. T. Hewitt, C. A. Keane, A. R. Ling, R. Meldola, E. J. Mills, J. C. Philip, J. M. Thomson (Chairman), Sir William A. Tilden, J. A. Voelcker, the Editor, and the Officers.

Publication Committee: Messrs. H. B. Baker, J. N. Collie, F. G. Donnan, B. Dyer, M. O. Forster, C. E. Groves, A. McKenzie, J. C. Philip, and the Officers.

Research Fund Committee Messrs. H. B. Baker, W. R. Bousfield, J. N. Collie, H. B. Dixon, J. J. Dobbie, M. O. Forster, A. Liversidge, R. Meldola, W. J. Pope, J. E. Reynolds, and the Officers.

Certificates were read for the first time in favour of Messrs.:

Thomas Allcock, The Rookery, Pye-Bridge, Alfreton.

Raymond Theodore Fred Barnett, B.Sc., 19, Merton Street, Swindon.

Charles James Vinall Bews, B.Sc., 52, Sir John's Road, Selly Park, Birmingham.

Harry Brindle, 225A, Oxford Road, Manchester.

Frank Lothian Cheshire, Mines Department, Brisbane, Queensland.

Alfred George Ernest Foster, 103, St. Mark's Road, Bristol.

Madanlal Jekisandas Gajjar, M.A., Heira House, Girgaum, Bombay.

Michael Francis Gallogly, B.A., St. Colman's College, Newry.

Robert Glegg, B.Sc., 19, Mount Street, Aberdeen.

Edmund Haworth Holden, M.Sc., 25, Curwen Street, Workington.

Edwin Oliver James, The Curatage, Low Moor.

Harold E. Kuntzen, Doric Lodge, Clapton Common, N.

James Leslie Auld Macdonald, B.Sc., 13, Howard Place, St. Andrews.

Nadirshaw Adarji Masani, M.A., B.Sc., Baroda Camp, India.

Harold McKee Langton, B.Sc., 80, Kingston Road, Ilford.

George Mason Williams, 17, Springcroft Avenue, Muswell Hill, N.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs. :

Jatindranath Ckakraorty, Goabagan, Calcutta.

Frederick George Whittick, Imperial Provincial College, Chinanfu, Shantung.

Of the following papers, those marked * were read :

***70. "Studies on platinocyanides." By Leonard Angelo Levy.**

The action of bromine on potassium platinocyanide has been reinvestigated, and it is found that Hadow's explanation of the reaction is correct, but that the constitution of the resulting product is represented by $6K_2Pt(CN)_4, K_2Pt(CN)_4, Br_2$, instead of the 5:1 formula given by him.

Lead and manganese dioxides oxidise potassium platinocyanide in the presence of dilute sulphuric acid, yielding a compound similar to the bromine additive product, in which Br_2 is replaced by SO_4 . The salt behaves like the sulphate of a feebly electro-positive element, and undergoes double decomposition with barium salts.

Hydrogen peroxide (and other peroxides in which the oxygen atoms are supposed to be linked in a chain) oxidises platinocyanides in the presence of dilute sulphuric acid, with the removal of one atom of the basic metal, forming compounds of the type $MPt(CN)_4$. These immediately combine with unchanged platinocyanide with the production of well-defined, crystallised double salts. The potassium compound has the composition



These double salts are not acted on by hydrogen peroxide, hence the product of the reaction is a platino-platinicyanide of this type. An exception is afforded by hydroplatinocyanic acid, in which the combination is so feeble that the action of hydrogen peroxide completely oxidises this substance to the compound $HPt(CN)_4$.

The combination between the platino- and platini-cyanide is destroyed by oxidation with "perhydrol," the platinocyanide being completely oxidised to the form $MPt(CN)_4$. These salts are

true platinicyanides, bearing a relationship to platinocyanides similar to that existing between ferro- and ferri-cyanides. They may be regarded as compounds of the cyanides with platinum tri-cyanide, $\text{MCN}, \text{Pt}(\text{CN})_3$. The oxidation of hydroplatinocyanic acid by hydrogen peroxide (6 per cent.) or "perhydrol" affords the readiest method of preparing the platinicyanides. Direct oxidation of metallic platinocyanides yields products which are mixed with the sulphate of the basic metal, and this is often very difficult to separate.

DISCUSSION.

Prof. EMERSON REYNOLDS congratulated Mr. Levy on his efforts to clear up the nature of some of the oxidation products of platinocyanides, although much still remained to be done. As illustrating this, he mentioned a curious observation of Sir J. Dewar's that an old specimen of supposed platinocyanide of lithium became *red* when cooled in liquid air, and lost the red colour when restored to the ordinary temperature. At Sir J. Dewar's request the speaker examined the specimen, which was nearly colourless—unlike pure, red, freshly prepared hydrated platinocyanide of lithium, which is bright green, and does not become red in liquid air. It had evidently undergone more or less oxidation in presence of a considerable excess of lithium cyanide, etc. This material when cooled in liquid air was seen to owe its red tint to minute red crystals distributed throughout, which were colourless at the ordinary temperature. The crystals closely resembled a large, orange-red crystal which the speaker had in his collection, and believed to be an oxidation product of a platinocyanide, having the formula $\text{Li}_2\text{Pt}(\text{CN})_5 \cdot 2\text{H}_2\text{O}$. This salt gave a colourless solution in water, from which colourless crystals were obtained, exhibiting a delicate lavender fluorescence; these contained 3 molecules of water of crystallisation. When cooled in liquid air these behaved just like Sir J. Dewar's salt, and gave the red dihydrate. On prolonged cooling a yellow monohydrate was formed as the red colour faded out. This remarkable example of successive dehydration by exposure to very low temperatures was reversed in presence of moisture as the normal temperature was reached. No compound exhibiting these characteristic properties had yet been met with among Mr. Levy's products, but the author would doubtless turn his attention in that direction, and the speaker hoped that he would obtain some clue to the constitution of the compound to which he (Prof. Reynolds) had now drawn their attention.

Mr. LEVY, in reply to Prof. Reynolds, said that a compound of the composition $\text{Li}_2\text{Pt}(\text{CN})_5$ could be regarded as a combination of lithium platinicyanide, $\text{LiPt}(\text{CN})_4$, with one molecule of lithium

cyanide. The action of cyanides (and other alkalis) on the platinum-cyanides, $\text{MPt}(\text{CN})_4$, resulted in the regeneration of a platinumcyanide, as the former could not exist in alkaline solution. All attempts to synthesise the compound $\text{Li}_2\text{Pt}(\text{CN})_5$ from lithium platinumcyanide and lithium cyanide were therefore unsuccessful. No evidence of the formation of compounds of the type $\text{M}_2\text{Pt}(\text{CN})_5$ was obtained in any of the experiments described.

***71. "Some reactions of β -naphthasulphonium-quinone."**

By Harold Christopher and Samuel Smiles.

It was shown that interaction of β -naphthasulphonium-quinone with acetyl chloride or hydrogen chloride yields chloronaphthathioxin, whilst acetic anhydride furnishes acetoxynaphthathioxin. An explanation of this type of interaction was offered, and a further study of the naphthathioxin group was made. Attention was drawn to the conversion of the oxides of the naphthathioxin series into the chloro-derivatives by interaction with hydrogen chloride, and to the consequent resemblance between this series and those of thiodiphenylamine and thianthren.

***72. "Asymmetric quaternary arsonium compounds and their attempted resolution." By Thomas Field Winmill.**

The author described several new reactions of the arsines and their halogen derivatives. He has prepared phenylbenzylethyl-*n*-propylarsonium iodide, phenylethyl-*n*-propylallylarsonium bromide, and phenylbenzylmethylallylarsonium iodide, but has failed to resolve these substances into optically active components by means of *d*- α -bromocamphor- π -sulphonic and *d*-camphor- β -sulphonic acids.

73. "The condensation of ethyl sodiomalonate with ethyl citraconate and the synthesis of β -methyltricarballic acid." By Edward Hope.

The author described in detail the condensation of ethyl sodiomalonate with ethyl citraconate, and discussed the mechanism of the production of a *cyclopentane* derivative when the reaction is carried out in alcoholic solution. The synthesis of β -methyltricarballic acid was also described.

74. "The formation and hydrolysis of esters of ketonic acids." By John Joseph Sudborough.

The esterification constants of several α -, β -, γ -, and δ -ketonic acids have been determined at 15° by the catalytic method, and in most

cases it is found that the introduction of carbonyl in place of a methylene group produces a retardation in the rate of esterification. It is also found that only those ketonic acids which are comparatively strong can be directly esterified by means of methyl alcohol.

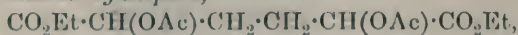
The hydrolysis of the esters of some of the ketonic acids with water, dilute hydrochloric acid, and dilute alkali has been examined. With water and also with alkali the strength of the acid from which the ester is derived appears to be an important factor.

75. "Purpurogallin. Part II." By Arthur George Perkin.

Purpurogallone (Perkin and Steven, *Trans.*, 1903, **83**, 192), $C_{11}H_5O_5$, gives *ethyl purpurogallone trimethyl ether*, $C_{11}H_4O(OMe)_4$, colourless prisms, m. p. 81—83°, and the *dianilide*, $C_{23}H_{18}O_3N_2$, colourless leaflets, m. p. 202—203°. With alcoholic hydrogen chloride *ethyl purpurogallone*, $C_{11}H_7O_4(OEt)$, yellow needles, m. p. 151—153°, is obtained, and by distillation with zinc dust naphthalene is produced. *isopurpurogallone*, $C_{22}H_{14}O_{10}$, also prepared by the action of alkali on purpurogallin, can be obtained by the action of sulphuric acid at 100°, or of sulphuric acid and persulphate at 0°, but more readily by oxidising purpurogallone in potassium acetate solution with potassium ferricyanide. *isopurpurogallone tetramethyl ether* is obtained in small amount by the methylation of purpurogallone, whereas the *diethyl* compound, $(C_{11}H_6O_5Et)_2$, leaflets, m. p. 217—218°, is prepared from *isopurpurogallone* with alcohol and hydrogen chloride. With alcoholic potassium hydroxide at 170°, purpurogallin trimethyl ether gives *purpurogallone dimethyl ether*, $C_{13}H_{12}O_5$, m. p. 197—199°, from which the *anhydro*-compound, $C_{13}H_{10}O_4$, m. p. 164—166°, is formed by sublimation or by means of boiling acetic anhydride. With boiling hydriodic acid (D 1·7) purpurogallone gives β -naphthol, 2:3-dihydroxynaphthalene, and a trace of an acid, probably 2:3-dihydroxynaphthalenecarboxylic acid. Purpurogallone is probably a *trihydroxynaphthalene-carboxylic acid*, and *isopurpurogallone* the corresponding *hexahydroxydinaphthylldicarboxylic acid*.

76. " $\alpha\delta$ -Derivatives of adipic and β -methyladipic acids." (Preliminary note.) By Harold Davies, Henry Stephen, and Charles Weizmann.

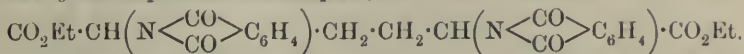
Ethyl $\alpha\delta$ -diacetoxyadipate,



is obtained by heating ethyl $\alpha\delta$ -dibromoadipate with anhydrous potassium acetate in glacial acetic acid solution. It is a white

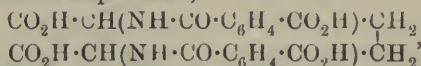
solid melting at 73°, and distilling without decomposition at 195°/10 mm.

Ethyl αδ-diphthaliminoadipate,



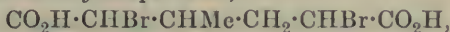
is obtained on heating ethyl αδ-dibromoadipate with potassium phthalimide in xylene for twenty-four hours. It crystallises from alcohol in colourless needles melting at 115°. The free *acid* is obtained by (a) hydrolysis of the ester with a glacial acetic acid solution of hydrogen bromide at the ordinary temperature, or (b) by the hydrolysis of the ester with the necessary amount of alcoholic potassium hydroxide; it is a crystalline powder which does not melt at 270°.

αδ-Diphthalaminoadipic acid,



is obtained by hydrolysing ethyl αδ-diphthaliminoadipate with concentrated aqueous sodium hydroxide according to Sørensen and Andersen's method (*Zeitsch. physiol. Chem.*, 1908, **56**, 266). When heated with concentrated hydrochloric acid, it yields αδ-diamino-adipic acid.

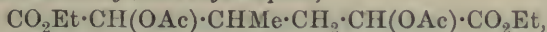
αδ-Dibromo-β-methyladipic acid,



is prepared by brominating β-methyladipyl chloride, and decomposing the product with anhydrous formic acid. On allowing the solution to remain for several weeks the acid crystallises. When recrystallised from anhydrous formic acid it melts at 138°.

The *methyl* ester boils at 167—168°/12 mm. The ethyl ester boils at 180°/10 mm.

Ethyl αδ-diacetoxy-β-methyladipate,

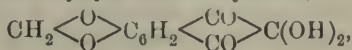


obtained in the same way as the analogous adipic compound, melts at 66° and boils at 182°/10 mm.

77. "Triketomethylenedioxyhydrindene"

By Siegfried Ruhemann.

Triketomethylenedioxyhydrindene hydrate,



has been obtained from the corresponding derivative of α-hydrindone by the same method which led to the formation of triketohydrindene hydrate. It is much less soluble in water than the latter substance,

but gives the same colour-reaction with amino-acids. The compound has been studied on the same lines as the parent substance (see *Trans.*, 1910, **97**, 1438, 2025; 1911, **99**, 792, 1306, 1486).

78. "Aromatic antimony compounds. Part IV. Compounds of antimony trichloride with diazonium chlorides." By Percy May.

Several additive compounds of antimony trichloride with various diazonium chlorides have been prepared. These compounds, which crystallise well, are insoluble in water, and more stable than the parent diazonium chlorides. The decomposition products of these substances were also described.

79. "Note on the constituents of rhubarb." By Frank Tutin and Hubert William Bentley Clewer.

In a former communication (*Trans.*, 1911, **99**, 962) the authors described the isolation from rhubarb of a small amount of a substance (m. p. above 340°), which yielded an acetyl derivative melting at 335° .

It has since been ascertained that this substance is identical with the phenolic compound, jambulol, which has quite recently been described by Power and Callan (*Pharm. J.*, 1912, [iv], **34**, 416).

Jambulol possesses the empirical formula $C_{10}H_3O_4(OH)_5$, but its molecular weight could not be determined owing to its sparing solubility.

80. "Molecular-weight determinations from the relative lowering of the vapour pressure of ethereal solutions." By Robert Wright.

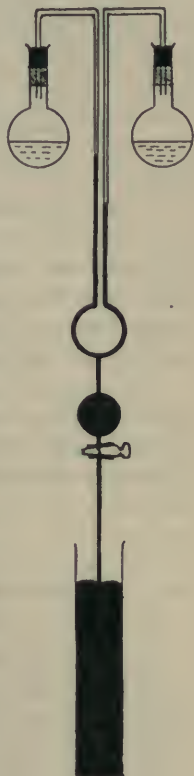
By the following method the chief difficulties of molecular-weight determination from the relative lowering of the vapour pressure of solutions have been to some extent avoided.

Two small flasks of about 100 c.c. capacity are connected by means of mercury-sealed stoppers to a differential manometer of the form shown. The height of the whole apparatus is about 60 cm., the bulb on the stem below the U-tube is of 15 c.c. capacity, and the length of stem below the mercury-sealed vacuum tap is about 30 cm., the height of the cylinder being 15 cm.

In a molecular-weight determination, one of the flasks marked in a suitable manner is fitted with a stopper, and weighed. Next

2—4 grams of solute are introduced, and its weight determined. Both flasks are now three-quarters filled with ether, and connected with the apparatus, the tap being left open, and the whole is clamped in position over the cylinder of mercury.

By means of beakers of hot water the ether in both flasks is alternately boiled and allowed to cool, the cooling being accelerated by immersing the flasks in cold water. Three such boilings are usually sufficient to sweep all air out of the apparatus; the ether should now fill from a quarter to a third of each flask; care should be taken that none of the solute crystallises out. The outsides of the flasks are now dried, and the mercury allowed to mount in the gauge. As soon as the mercury has risen so as to occupy half the bulb, the ether which has condensed on the surface of the rising column is driven back into the flasks by gently heating the bulb with a small flame. It is advisable during this part of the operation to warm gently all that part of the gauge which is above the bulb.



The whole apparatus is now placed in a glass-fronted cupboard, and left for three or four hours, so that it may cool to the temperature of the room. Both flasks are now gently tapped so as to shake their contents, and ten minutes later the difference in height of the mercury columns read by means of a cathetometer. This difference—which should be about 3 cm.—is the lowering of the vapour pressure due to the solute. In order to disconnect the flasks, the apparatus is raised until the end of the gauge is only about 1 cm. below the surface of the mercury in the cylinder; the flasks are then, if necessary, gently warmed with the hand until the mercury in the manometer is depressed so as to occupy a level below the tap, which is then closed, and the whole apparatus lifted free from the cylinder. On opening the tap, air is admitted to the flasks, and the one containing the solution is disconnected, stoppered, and weighed, and by this means the weight of the ether obtained.

The molecular weight of the solute is now calculated from the formula:

$$\frac{f-f'}{f} = \frac{W/M}{w/m},$$

where f and f' are the vapour pressures of solvent and solution, W and M the mass and molecular weight of the solute, and w and m those of the solvent.

The value of f , the vapour pressure of the pure solvent, is best obtained by noting the temperature of the experiment and consulting a table of vapour pressures, interpolating, if necessary, by means of the usual logarithmic rule. This avoids errors due to impurities in the ether, which will not affect the differential value $f - f'$.

The following are a few typical results; in general it will be seen that the errors are less than 10 per cent.

	M.W. found.	True M.W.
Nitrobenzene	129	123
Azobenzene.....	190	182
Benzoic acid	112	122
Aniline	98	93
Naphthalene	135	128

As the object of the experiments was not a research on vapour pressures, but a simple method of determining molecular weights, no great care was taken to obtain perfectly pure reagents. The ether was the methylated variety which had been washed and redistilled, and the solutes purified in the usual manner gave sharp melting or boiling points.

The stoppers used were of capillary rubber tubing, a substance not altogether suitable owing to the solubility of ether in it; but as the only effect of this solubility is the removal of some ether from the solution, the use of rubber does not materially affect the results.

81. "Electrolytic reduction. Part I. Unsaturated aldehydes and ketones." By Herbert Drake Law.

A large number of unsaturated aldehydes and ketones have been reduced on lead cathodes by the electrolytic method. The reaction takes place in stages, and commences at either the double linking or the carbonyl radicle. The products are saturated alcohols, unsaturated alcohols, or ketones of approximately the same molecular weight of the original substance, together with diketones and pinacones of double the molecular formula. The reaction proceeds quite readily with aliphatic and alicyclic compounds in either acid, alkaline, or neutral solvents. Reduction is most rapid when acid electrolytes are used, but products combined with the lead of the cathode are formed. The latter phenomenon is quite general with the compounds examined in both aliphatic and alicyclic series, and greatly interferes with the usefulness of the

reaction. The substances easiest to reduce are those containing the double linking and the carbonyl groups in adjacent positions. The separation of these two groups greatly reduces the reactivity, and compounds with only one of the groups are moderately stable. The two double linkings therefore mutually exalt the properties of the other when brought close together, but still retain their individuality.

82. "A method of estimating potassium iodate."

By James Eckersley Myers.

When solutions of potassium iodate and oxalic acid are mixed together, or the substances suspended in water, a slight yellow colour is developed after several hours at the ordinary temperature.

On heating the mixture to 80° , a vigorous reaction commences, and continues without any further application of heat, with the evolution of carbon dioxide and iodine.

This reaction was examined quantitatively by Chrétien (*Ann. Chim. Phys.*, 1898, [vii], 15, 358), and he found that the whole of the iodine present in the iodate was evolved in the free state, but gave no figures to indicate the degree of accuracy of the method. The present method is similar to Chrétien's, but can be carried out much more quickly.*

A weighed amount of pure potassium iodate is placed together with an excess of pure oxalic acid in a flask fitted with a ground-glass joint, which carries the exit tube. A tube for conducting steam into the flask is sealed into the side of the neck, and reaches nearly to the bottom of the flask. The arrangement of these tubes prevents the existence of the cul-de-sac which exists in an ordinary steam-distillation apparatus, and so allows the iodine to be swept out by the steam without obstruction. Steam is passed into the mixture so as to attain the temperature of reaction. When the iodine commences to be evolved, the flow of steam is slackened, and the iodine gradually swept out of the flask into a receiver cooled in ice, containing potassium iodide solution. If desired, this solution may be replaced by a mixture of potassium iodide and a known volume of standard sodium thiosulphate. After a short time the contents of the reaction flask become quite colourless, and no iodine remains in the delivery tube. After the steam has been stopped, the receiver is removed, and the tip of the delivery tube washed, the washings being placed in the receiver. If the iodine is collected in potassium iodide, this is titrated with standard sodium thio-

* The work described in the present communication was carried out in ignorance of Chrétien's investigation.

sulphate solution; if collected in thiosulphate solution the excess of this reagent is titrated with standard iodine. In either case a measure of the amount of iodine produced in the reaction is obtained. The following table shows the amounts of iodate used (*a*), the amounts of iodine produced (*b*), together with the ratio *a/b*:

TABLE I.

	<i>a.</i>	<i>b.</i>	<i>a/b.</i>
1.	0·283 gram	0·168 gram	1·684
2.	0·306 „	0·182 „	1·681
3.	0·486 „	0·292 „	1·674
4.	0·500 „	0·296 „	1·689
5.	0·601 „	0·357 „	1·683
6.	0·659 „	0·389 „	1·690
7.	0·994 „	0·589 „	1·687

The value for the ratio will be seen to be practically constant, and it agrees very well with the ratio $2\text{KIO}_3/\text{I}_2$, the calculated value of which is 1·685.

The next table shows a comparison of the amounts of iodine calculated on the assumption that two molecules of potassium iodate produce one molecule of iodine (*a*), with the amounts of iodine experimentally determined (*b*). *A* is the weight of iodate used.

	<i>A.</i>	<i>a.</i>	<i>b.</i>
1.	0 283 gram	0·168 gram	0·168 gram
2.	0·306 „	0·181 „	0·182 „
3.	0·486 „	0·288 „	0·292 „
4.	0·500 „	0·296 „	0·296 „
5.	0·601 „	0·356 „	0·357 „
6.	0·659 „	0·391 „	0·389 „
7.	0·994 „	0·589 „	0·589 „

The effects of various salts on the reaction are as follows:

Potassium Nitrate:—The amount of iodine produced as determined by titration is too high, probably owing to the formation of a little nitric acid which passes over to the potassium iodide solution and liberates iodine.

Potassium Chromate and Sulphate:—These salts do not affect the reaction.

Potassium Chloride and Chlorate:—These salts prevent the formation of iodine, although in the case of chlorate carbon dioxide is given off

Potassium Bromate:—On gently warming the mixture to about 30° , the bromate and oxalic acid react to form bromine and carbon dioxide. After some time the bromine ceases to be evolved, and the solution may be almost freed from bromine by gentle warming. On heating to about 80° the iodate and oxalic acid react to produce iodine and carbon dioxide. This reaction presents a convenient

method of detecting, qualitatively, a mixture of potassium bromate and iodate.

The action of oxalic acid on potassium bromate, both alone and in presence of other salts, is under investigation.

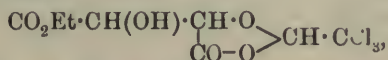
83. "The action of sodium hyposulphite on copper sulphate in aqueous solution." By James Brierley Firth and James Eckersley Myers

This reaction has been examined under various conditions, and it has been found that the final products vary with the relative amounts of the reacting substances. When the copper salt is in excess the product is chiefly metallic copper, and this may be precipitated in a very active form, which on exposure to the air becomes light brown, and has then a composition indicating the presence of cuprous oxide. If the sodium hyposulphite is in excess, the product is chiefly cupric sulphide. The authors are unable to confirm the observation of Schützenberger that copper hydride is produced in the reaction.

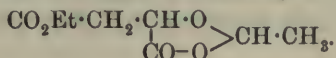
An improved form of the apparatus used for precipitating, filtering, and drying in an inert gas was used in this investigation.

84. "The action of chloral on ethyl tartrate and on ethyl malate." By Thomas Stewart Patterson and Andrew McMillan.

Chloral condenses with ethyl tartrate to give an additive compound of the formula:



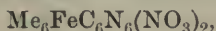
and with ethyl malate to furnish the analogous compound:



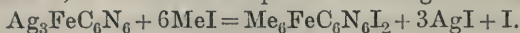
85. "The alkylation of the ferro- and ferri-cyanides." By Ernald George Justinian Hartley.

Methyl sulphate reacts with potassium ferricyanide at 100°, reduction taking place, and the same products are obtained as when the ferrocyanide is employed.

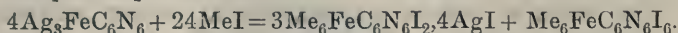
Methyl iodide when heated with silver ferrocyanide in a sealed tube forms a compound, $\text{Me}_6\text{FeC}_6\text{N}_6\text{I}_2 \cdot 4\text{AgI}$, which is decomposed by nitric acid or silver nitrate into the compound



and silver iodide. When silver ferricyanide and methyl iodide are similarly treated, reduction takes place according to the equation:

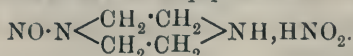


The hexamethylferrocyanogen iodide then combines partly with the silver iodide and partly with the free iodine to form a periodide. The complete equation is:



86. "Nitrites of the alicyclic ammonium series. Part I. Nitrosopiperazinium nitrite." By Prafulla Chandra Rây and Jitendra Nath Rakshit.

When the filtrate from the double decomposition between piperazinium hydrochloride and silver nitrite in aqueous solution is allowed to evaporate slowly in a vacuum over sulphuric acid, the first crop or two of crystals consists of pure 1:4-dinitrosopiperazine. The last crops are those of *nitrosopiperazinium nitrite*,



87. "The molecular conductivities of potassium nitrite, mercuric nitrite, and potassium mercurinitrite." By Prafulla Chandra Rây and Nilratan Dhar.

From the conductivity measurements of the above salts it would appear that potassium mercurinitrite is almost completely decomposed in aqueous solution into its components, and that it does not consist of kalion, (K°), and mercurinitrosion, $\text{Hg}(\text{NO}_2)_4''$, as is supposed by Ostwald.

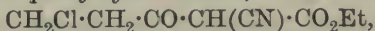
88. "A method of estimating tin in its ores, alloys, and compounds." By Manindra Nath Banerjee and Satish Chandra Banerjee.

Stannous chloride, prepared from tin ores, alloys, and compounds, is easily titrated with *N*/10-mercuric chloride solution, the indicator used being potassium iodide solution. The solution is "spotted" on a porcelain tile, and the end reaction is indicated when a drop of the tin solution under titration colours the iodide yellow owing to excess of mercuric chloride.

89. "Condensation of acid chlorides with the ethyl esters of (a) cyanoacetic acid, (b) malonic acid, and (c) acetoacetic acid." (Preliminary note.) By Charles Weizmann, Harold Davies, and Henry Stephen.

The following condensation products have been prepared with the view of using them for the preparation of amino-ketones and their derivatives:

Ethyl β-chloropropionylcyanoacetate,



prepared from β-chloropropionyl chloride and ethyl sodiocyanoacetate, crystallises from a mixture of benzene and light petroleum, and melts at 68°; it gives a *copper* compound melting at 159°.

Ethyl phenoxyacetylcyanoacetate,



prepared from phenoxyacetyl chloride and ethyl sodiocyanoacetate, yields a *copper* compound melting at 191°. The free condensation product prepared from this copper compound crystallises from light petroleum, and melts at 44°.

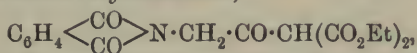
Ethyl ethoxyacetylmalonate, $\text{EtO}\cdot\text{CH}_2\cdot\text{CO}\cdot\text{CH}(\text{CO}_2\text{Et})_2$, obtained from ethoxyacetyl chloride and ethyl sodiomalonate in dry benzene, is an oil boiling at 165°/19 mm.

Ethyl ethoxyacetylacetoacetate, $\text{EtO}\cdot\text{CH}_2\cdot\text{CO}\cdot\text{CHAc}\cdot\text{CO}_2\text{Et}$, prepared from ethoxyacetyl chloride and ethyl sodioacetoacetate in dry benzene, is best purified by means of the *copper* compound. It boils at 132—133°/12 mm.

Ethyl phenoxyacetylacetoacetate, $\text{PhO}\cdot\text{CH}_2\cdot\text{CO}\cdot\text{CHAc}\cdot\text{CO}_2\text{Et}$, obtained by condensing phenoxyacetyl chloride and ethyl sodioacetoacetate, is a solid melting at 85—86°. It is best purified through the *copper* compound, and gives the ferric chloride reaction.

Ethyl amyloxyacetylacetoacetate, $\text{C}_5\text{H}_{11}\cdot\text{O}\cdot\text{CH}_2\cdot\text{CO}\cdot\text{CHAc}\cdot\text{CO}_2\text{Et}$, prepared from sodium acetoacetate and amyloxyacetyl chloride, is a liquid boiling at 176°/14 mm.

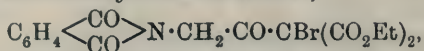
Ethyl phthaliminoacetylmalonate,



obtained from phthalylglycyl chloride and ethyl sodiomalonate in dry benzene, is a white solid, which crystallises from alcohol, and melts at 68°. When submitted to steam distillation in presence of dilute sulphuric acid, it yields phthaliminoacetone (m. p. 124°). The residue, an oil insoluble in sodium carbonate, yields, on crystallisation from alcohol, ethyl phthaliminoacetoacetate (m. p. 119°), identical with the compound described by Gabriel and Colman (*Ber.*, 1909, **42**, 1244). This substance does not give a coloration

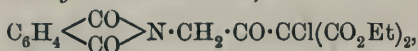
with ferric chloride,² but when its alcoholic solution is mixed with a solution containing an equimolecular quantity of potassium ethoxide in alcohol, a crystalline potassium compound is obtained, which, when dissolved in water and decomposed with cold dilute acetic acid, yields the enolic modification of *ethyl phthaliminoacetoacetate*, melting at 70°, and gives a purple coloration with ferric chloride.

Ethyl phthaliminoacetyl bromomalonate,



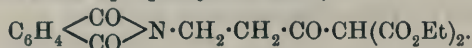
is obtained when ethyl phthaliminoacetylmalonate is treated with a 20 per cent. solution of bromine in chloroform. It crystallises from methyl alcohol in colourless needles melting at 123°.

Ethyl phthaliminoacetyl chloromalonate,



prepared by heating phthalylglycyl chloride with the potassium compound of ethyl chloromalonate in dry benzene, crystallises from methyl alcohol in colourless needles, melting at 99°. On distillation in a current of steam in presence of dilute sulphuric acid, it yields phthaliminoacetic acid.

Ethyl β-phthaliminopropionylmalonate,



obtained in a manner similar to that described in the preparation of ethyl phthaliminoacetylmalonate, crystallises from methyl alcohol in needles melting at 62°.

β-Phthaliminopropionic acid,



was obtained by hydrolysis of the corresponding amyl ester by means of concentrated hydrobromic acid at 40°.

Amyl β-phthaliminopropionate is easily obtained by heating molecular quantities of potassium phthalimide and amyl β-chloropropionate. It melts at 56°, and distils at 220°/12 mm. without decomposition.

90. "The rate of reduction of carbon dioxide by carbon."

By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

The velocity of the reaction $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$ at different temperatures has been determined. The velocity of reaction increases with increase of temperature, the mean velocity ratios for a temperature interval of 10° diminishing fairly regularly as the temperature scale is ascended.

Thus, in a series of experiments in which a mixture containing 20 per cent. of carbon dioxide and 80 per cent. of nitrogen was employed, the following mean values of k at different temperatures were obtained $\left(k = \frac{1}{t} \cdot \log \frac{C_o}{C_t}\right)$:

Temperature.	$k(t=1 \text{ minute}).$
900°	0·00060
950	0·00374
1000	0·01764
1050	0·05760
1100	0·10570

The mean velocity ratios for an interval of 10°, obtained from the expression $\frac{k_{t+10}}{k_t} = 10^{10b}$, are given in the following table, together with the values of b obtained from the experimental numbers:

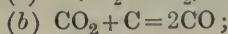
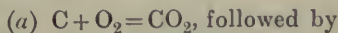
Temperature range.	$b.$	$k_{t+10}/k_t.$
900—950°	0·01589	1·44
950—1000	0·01346	1·36
1000—1050	0·01028	1·27
1050—1100	0·00527	1·13

91. "The combustion of carbon."

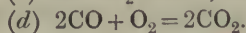
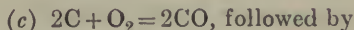
By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

Work by previous experimenters regarding the first reaction that takes place when carbon burns in oxygen was discussed.

The alternatives are:



and



The authors attempted to obtain evidence as to which reaction is most likely to take precedence at different temperatures, by determining the relative velocities of the above reactions under the same experimental conditions.

The results obtained showed (1) that some carbon monoxide is produced during the oxidation of carbon at low temperatures, under conditions which do not admit of the reduction of carbon dioxide by carbon. On the other hand, (2), carbon dioxide is produced at low temperatures in quantity which cannot be altogether accounted for by the supposition that carbon monoxide is first formed and then oxidised to carbon dioxide.

When carbon is burned at low temperatures, therefore, carbon dioxide and carbon monoxide are produced simultaneously.

An account of experiments made to discover the nature of the reaction responsible for this simultaneous production of the two oxides was reserved for a future communication.

92. "The use of phenolphthalein as an indicator. The slow rate of neutralisation of carbonic acid." By James William McBain.

It was shown that titrations with phenolphthalein as indicator require about ten minutes for the end-point to be attained, even in the absence of a gaseous space. This is not due to changes in the phenolphthalein, for these are not appreciable during many months in very low concentration of alkali (about 0.7×10^{-6} $N\text{-OH}'$). The phenomenon has been traced to the presence of carbon dioxide (carbonate), which is always intentionally or unintentionally present. It is uncertain which is the slow reaction, the rate of hydration of dissolved carbon dioxide or the rate of electrolytic dissociation of the carbonic acid.

Carbon dioxide affects the amount of phenolphthalein necessary to produce maximum depth of colour, but it also affects enormously the amount of acid or alkali required to change the colour of the end-point by a definite amount.

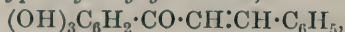
The very pale colour obtained at a concentration of $\text{OH}' =$ about 0.7×10^{-6} was shown to be the most sensitive colour for the end-point, and permanent colour standards were described which identify this region. It was recommended that in titrating, before either of the liquids to be titrated are placed in the titration vessel, the water in the latter should be coloured to the position of the final end-point with phenolphthalein and alkali.

93. "Some hydroxy-ketonic dyes."

By Jatindra Mohan Dutta and Edwin Roy Watson

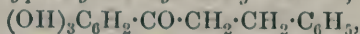
On account of their resemblance to the flavones and butein, the following compounds have been prepared:

2:3:4-Trihydroxyphenyl styryl ketone,



obtained by the condensation of cinnamic acid and pyrogallol with zinc chloride, forms chocolate-coloured, plate-like crystals, melting at $125\text{--}126^\circ$.

2:3:4-Trihydroxyphenyl benzylmethyl ketone,



prepared by condensing β -phenylpropionic acid and pyrogallol, crystallises in light pink, prismatic crystals, melting at $86\text{--}87^\circ$.

2:3:4-Trihydroxyphenyl 2'-hydroxystyryl ketone,



prepared from *o*-hydroxycinnamic acid and pyrogallol, melts at 170°.

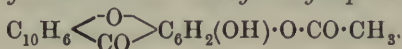
2:4-Dihydroxyphenyl 2'-hydroxystyryl ketone,
 $(\text{OH})_2\text{C}_6\text{H}_3\cdot\text{CO}\cdot\text{CH}:\text{CH}\cdot\text{C}_6\text{H}_4\cdot\text{OH},$

prepared from *o*-hydroxycinnamic acid and resorcinol, melts at 124—126°.

2:4-Dihydroxyphenyl 2'-hydroxynaphthyl ketone,
 $(\text{OH})_2\text{C}_6\text{H}_3\cdot\text{CO}\cdot\text{C}_{10}\text{H}_6\cdot\text{OH},$

prepared from β -naphtholcarboxylic acid and resorcinol, forms brown, plate-like crystals melting at 204—206°.

The monoacetyl derivative of dihydroxynaphthaxanthone,



prepared by boiling 2:3:4-trihydroxyphenyl 2'-hydroxynaphthyl ketone with acetic anhydride and a trace of pyridine, melts at 200°.

Acetoxynaphthaxanthone, $\text{C}_{10}\text{H}_6\left\langle\begin{smallmatrix}\text{O}\\\text{CO}\end{smallmatrix}\right\rangle\text{C}_6\text{H}_3\cdot\text{O}\cdot\text{CO}\cdot\text{CH}_3,$ pre-

pared similarly from 2:4-dihydroxyphenyl 2'-hydroxynaphthyl ketone, forms cream-coloured, needle-shaped crystals, melting at 217°.

3:4-Dihydroxynaphthaxanthone, $\text{C}_{10}\text{H}_6\left\langle\begin{smallmatrix}\text{O}\\\text{CO}\end{smallmatrix}\right\rangle\text{C}_6\text{H}_2(\text{OH})_2,$ pre-

pared by heating 2:3:4-trihydroxyphenyl 2'-hydroxynaphthyl ketone in a sealed tube with water, and also by the hydrolysis of its monoacetyl derivative, forms small, plate-like crystals, melting at 280—285°.

Hydroxynaphthaxanthone, $\text{C}_{10}\text{H}_6\left\langle\begin{smallmatrix}\text{O}\\\text{CO}\end{smallmatrix}\right\rangle\text{C}_6\text{H}_3\cdot\text{OH},$ prepared by

the hydrolysis of acetoxynaphthaxanthone, forms needle-shaped crystals which do not melt at 285°.

The dyeing properties of some of the above compounds were described.

94. "The externally compensated and optically active hydroxyhydrindamines, their salts and derivatives." By William Jackson Pope and John Read.

Methods were given for the preparation in quantity of externally compensated hydroxyhydrindamine, $\text{C}_6\text{H}_4\left\langle\begin{smallmatrix}\text{CH}_2\\\text{CH}(\text{OH})\end{smallmatrix}\right\rangle\text{CH}\cdot\text{NH}_2,$ and for the resolution of this base into its optically active components by means of *d*- α -bromocamphor- π -sulphonic acid. The rotation constants of the *d*- and *l*-hydroxyhydrindamines and a number of their salts and derivatives have been determined.

95. "The four stereoisomeric optically active 2:4-dimethyltetrahydroquinolines." By John Thomas.

The molecule of 2:4-dimethyltetrahydroquinoline contains two asymmetric carbon atoms, and the synthetic product, obtained by the reduction of 2:4-dimethylquinoline, should therefore be resolvable into four optically active isomerides. The four isomerides in question can be isolated from the synthetic base by crystallisation with the *d*- and *l*- α -bromocamphor- π -sulphonic acids.

96. "The optical activity of salts and derivatives of *d*-camphor- β -sulphonic acid." By Joseph Ivon Graham.

For the purpose of ascertaining to what extent the molecular rotatory powers are dependent on concentration, the optical rotations (at constant temperature) of a number of salts of *d*-camphor- β -sulphonic acid in aqueous solution have been determined for the mercury-green, mercury-yellow, and sodium *D*-lines. In the case of the zinc, cadmium, and magnesium salts, no appreciable change in rotatory power is observed on increasing the concentration, whilst the barium, calcium, and copper salts show a diminution of rotatory power, and the ammonium and piperidine salts show an increase of rotatory power under similar conditions. On the other hand, no change in rotatory dispersion is produced by varying the concentration of the salts.

It is concluded that these changes cannot be dependent on variation of degree of electrolytic dissociation alone, but depend principally on the character of the metallic atom or electropositive group. The "piperido-lactone" of this acid is now proved to be the piperidine salt.

The rotation constants of other derivatives, for example, the chloride, piperidide, and the anhydramide, in chloroform solution have also been determined, and the influence of change of constitution on rotatory dispersion is illustrated in the case of the anhydramide in which the nitrogen atom has become linked to the carbon of the carbonyl group.

97. "Some mixed phosphonium derivatives."
By William Jackson Pope and Charles Stanley Gibson.

The authors described the preparation of phenyl-*p*-tolylmethylallylphosphonium and phenyl-*p*-tolylbenzylmethylphosphonium compounds and related substances; they were unable to resolve these compounds, which contain an asymmetric quinquivalent phosphorus atom, into optically active components.

98. "The alkaloidal salts of phenylmethylphosphinic acid."

By William Jackson Pope and Charles Stanley Gibson.

Salts of phenylmethylphosphinic acid, $\text{CH}_3 \cdot (\text{C}_6\text{H}_5)\text{P} \cdot \text{O} \cdot \text{OH}$, with *l*-menthylamine, cinchonine, cinchonidine, quinine, and *l*-hydroxyhydrindamine have been prepared and submitted to careful fractional crystallisation without evidence of resolution being obtained. It thus appears that phenylmethylphosphinic acid is not resolvable into optically active components.

99. "The state of ammonia in aqueous solution."

By Thomas Field Winmill.

For the calculation of the complete equilibrium,



it is necessary to know the "apparent dissociation constant" of ammonia, and also the partition-coefficient between water and an indifferent solvent at three temperatures. The necessary measurements have been made for ammonia, mono-, di-, and tri-methylamine, mono-, di-, and tri-ethylamine, and mono-, di-, and tri-propylamine at 18°, 25°, and 32·35°.

100. "The absorption spectra of some metallic solutions."

By Sir Walter Noel Hartley.

Konrad Schaefer has investigated the absorption spectra of nitrates (*Zeitsch. wiss. Photochem.*, 1910, **8**, 212), and whilst confirming the author's observations in all particulars (*Trans.*, 1902, **81**, 556; 1903, **83**, 221), has somewhat extended them.

Prior to the publication of this paper in 1903, the author had examined thin layers of molten potassium nitrate 0·5 mm. in thickness, but found no selective absorption. The absorption spectra of metallic nitrates and of alkyl nitrates, the former in the state of solution and solid (Schaefer), the latter both as liquid, as solution in alcohol, and as vapour, are indisputable evidence that the bands of absorption in the former belong to the salt molecule, and that as under no condition do the alkyl nitrates exhibit such selective absorption, their constitution must be essentially different. The effect of solution on the absorption spectra of different nitrates (with the author's explanation Schaefer does not agree) are explained on the view that they are not ionised.

101. "The absorption spectra of permanganates."

By Sir Walter Noel Hartley.

J. E. Purvis has examined the influence of dilution on the colour and the absorption spectra of various permanganates (*Proc. Camb.*

Phil. Soc., 1909, **15**, 111), but his views, based on ionisation, do not satisfactorily explain the changes observed. A simpler explanation is offered similar to that given in the case of nitrates which form basic salts, and in particular thorium nitrate. A similar change takes place in manganese nitrate and in manganese sulphate. In the latter salt a transient absorption band which is feeble becomes a continuous absorption, and is evidently caused by the oxidation of the salt in solution. It indicates the progress of a chemical reaction, and the band disappears when the reaction is completed.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Coste, John Henry. The calorific power of gas. A treatise on calorific standards and calorimetry. London 1911. pp. xvi+310. ill. 6s. net. (*Recd.* 2/4/12.) From the Author.

Ferguson, John. *Bibliotheca Chemica*: A catalogue of the alchemical, chemical, and pharmaceutical books in the collection of the late James Young of Kelly and Durris, Esq., LL.D., F.R.S., F.R.S.E. Glasgow 1906. 2 vols. pp. xxi+487, 598. Printed for private distribution. (*Recd.* 3/4/12.)

From the Trustees and Family of the late Dr. James Young.

Merck, E. Prüfung der chemischen Reagenzien auf Reinheit. 2nd edition. Darmstadt 1912. pp. v + 332. M.3.— (*Recd.* 21/3/12.) From the Author.

Parry, Ernest John. Food and drugs. Vol. I. The analysis of food and drugs (chemical and microscopical). Vol. II. The Sale of Food and Drugs Acts, 1875–1907. London 1911. pp. viii+744, 181. ill. 28s. 6d. net. (*Recd.* 15/4/12.) From the Author.

II. *By Purchase.*

Süvern, Karl. Die künstliche Seide. Ihre Herstellung, Eigenschaften und Verwendung. 3rd edition. Berlin 1912. pp. xi+631. ill. M.18.— (*Recd.* 26/3/12.)

III. *Pamphlets.*

Auerbach, Friedrich, and Pick, Hans. Die Alkalität wässriger Lösungen kohlensaurer Salze. (From the *Arbeit. K. Gesundheitsamte*, 1911, 38.)

Autenreith, W., and Müller, Gerhard. Ueber die kolorimetrischen Bestimmungen des Zuckers, Kreatins und Kreatinins im Harn. (From the *München. med. Wochensch.*, No. 17, 1911.)

Autenreith, W., and Funk, Albert. Ueber die kolorimetrische Bestimmung des Milchzuckers im Harn und in der Milch. (From the *München. med. Wochensch.*, No. 32, 1911.)

Ball, John. The meteorite of El Nakhla el Baharia. pp. 20. Cairo 1912.

Bang, Ivar. Ueber den chemischen Vorgang bei der Milchgerinnung durch Lab. (From the *Skand. Arch. Physiol.*, 1911, 25.)

Barger, George, and Dale, Henry Hallett. β -Iminazolyethylamine a depressor constituent of intestinal mucosa. (From the *J. Physiol.* 1911, 41.)

Blount, Bertram. Lectures on cement. pp. 64. ill. London 1912.

Corridi, Lamberto. Contributo allo studio dei prodotti di assorbimento dell' Iodio. (From the *Arch. Farm. speriment. Sci.*, 1911, 12.)

Diamare, Vincenzo. Sur le diabète pancréatique chez les hétérothermes. (From the *Arch. ital. biol.*, 55.)

Golding, John. Ropy milk. (From the *J. of the Board of Agric.*, 1912, 18.)

Holmberg, Bror. Ueber optisch aktive Dibrombernsteinsäuren. (From the *Svensk Kemisk Tidskrift*, 1911.)

Metropolitan Water Board. Seventh report on research work. By A. C. Houston. pp. 79. London 1911.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 3rd, 1912.

All persons who received grants in June, 1911, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Saturday, June 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is applied to investigations relating to problems connected with the coal-tar and allied industries.

VAN'T HOFF MEMORIAL FUND.

The Treasurer has forwarded to the van't Hoff Committee in Amsterdam the sum of £64 4s. (=770 Florinus), being the subscriptions received by him from Fellows of the Society and others as per the following list:

	£	s	d.		£	s	d.
				Brought forward	31	2	0
Mr. H. Bassett, sen.	0	10	6	Dr. J. Lewkowitsch	1	1	0
Dr. G. T. Beilby	5	0	0	Prof. G. D. Liveing	1	0	0
Mr. E. J. Bevan	1	1	0	Prof. A. Liversidge	1	1	0
Mr. W. R. Bousfield	1	1	0	Dr. A. McKenzie	1	1	0
Dr. Horace T. Brown	1	1	0	Prof. R. Meldola	1	0	0
Dr. J. C. Cain	0	10	6	Dr. R. Messel	5	0	0
Cambridge University				Sir Henry A. Miers	1	0	0
Chemical Club... ..	2	0	0	Prof. G. T. Morgan	0	10	6
Mr. A. Chaston Chapman .	1	1	0	Dr. Hugo Müller	1	1	0
Sir Arthur H. Church... ..	1	1	0	Prof. A. G. Perkin	2	2	0
Prof. J. Norman Collie	1	1	0	Prof. W. H. Perkin	2	2	0
Mr. C. F. Cross	1	1	0	Dr. J. C. Philip	0	10	6
Prof. Arthur W. Crossley	1	1	0	Mr. S. P. U. Pickering	1	1	0
Prof. A. E. Dixon	1	0	0	Prof. T. Purdie	2	2	0
Prof. H. B. Dixon	2	2	0	Sir William Ramsay	2	2	0
Dr. M. O. Forster	1	1	0	Sir Boverton Redwood... ..	1	1	0
Prof. Percy F. Frankland	3	3	0	Rt. Hon. Sir Henry E. Roscoe	1	0	0
Prof. A. G. Green	1	1	0	Dr. S. Ruhemann	1	0	0
Mr. A. J. Greenaway	0	10	6	Dr. Alexander Scott	1	1	0
Mr. C. E. Groves	1	1	0	Dr. G. Senter	0	10	6
Dr. A. G. Vernon Harcourt	1	1	0	Prof. A. Smithells	1	1	0
Dr. A. Harden	1	1	0	Sir William A. Tilden	0	10	6
Dr. J. T. Hewitt	1	1	0	Dr. J. A. Voelcker	1	1	0
Dr. A. Lapworth	1	1	0	Prof. J. Walker	2	2	0
Dr. H. R. Le Sueur	0	10	6	Prof. W. P. Wynne	1	1	0
Carried forward	£31	2	0	Total	£64	4	0

The next Ordinary Scientific Meeting will be held on **Thursday, May 2nd, 1912, at 8.30 p.m.**, when there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Nor-hyoscyamine and nor-atropine. Alkaloids occurring in various solanaceous plants." By F. H. Carr and W. C. Reynolds.

"Researches on the constitution of physostigmine. Part I." By A. H. Salway.

"The 'true' ionisation and hydration constants of ammonia and some amines, with a note on the formulation of nitrogen compounds." By T. S. Moore.

CERTIFICATES OF CANDIDATES FOR ELECTION
AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on May 2nd, 1912.

Arkell, Daniel,

South Lawn, Clanfield, Oxon.

Science Teacher. B.Sc. London University, 1901. Science Master, Ampleforth College, Yorks, 1902–1907. Science Master, S. Philip's Grammar School, Birmingham, 1908–1912. Science Master, Oratory School, Birmingham, 1908–present time.

Douglas F. Twiss.

E. T. Bucknell.

T. Slater Price.

W. B. Davidson.

Lionel M. Jones.

Bartow, Arthur Leslie,

“Kingscot,” Ruislip.

Analytical Chemist and Bacteriologist. Assistant Analyst and Bacteriologist to the Belgravia Dairy Co., Ltd. Formerly student for 2 years in Chemistry department, Goldsmith's Institute, under Dr. Arthur Lapworth.

Arthur Lapworth.

C. G. Moor.

Herbert E. Burgess.

H. Droop Richmond.

Albert E. Bell.

Bones, Arthur Anderson,

640, Schoeman Street, Pretoria, South Africa.

Pharmacist. Managing Director of A. A. Bones & Co., Ltd., Pretoria, S. Africa, Manufacturing Pharmaceutical Chemists, by appointment to the Army and Civil Service in South Africa, and Manufacturers of Aerated Mineral and Medical Waters; formerly Assistant Pharmacist to Guy's Hospital, London.

B. Owen Jones.

W. F. Wyley.

J. H. Dinwoodie.

Hy. Williams Jones.

Thomas Maben.

Bryant, Ernest Gower,
100, Burlington Street, Manchester.

Principal of Northern College of Pharmacy, Manchester.
Pharmaceutical Chemist. For the last eight years engaged in manufacturing Pharmacy and Analytical Chemistry, and teaching of Pharmacy.

Walter M. Gardner.

George Clayton.

Barker North.

G. T. W. Newsholme.

Robert Wright.

R. L. Taylor.

Bury, Charles Rugeley,
Ellfield, Wootton-under-Edge, Gloucestershire.

B.A. (Oxford). Demonstrator at Trinity and Balliol Colleges
Laboratory. Engaged in Research.

D. H. Nagel.

N. V. Sidgwick.

H. B. Hartley.

A. F. Walden.

B. Lambert.

Cooper, Evelyn Ashley,
"Arborfield," Woodcote Valley Road, Purley, Surrey.

Beit Memorial Fellow for Medical Research at Lister Institute.
Associate of Royal College of Science, London, in Chemistry, 1907.
B.Sc. (2nd Class Honours in Chemistry), London, 1907. Bacteriological Chemist at "Sanitas" Co., Ltd., 1908-9. Jenner Memorial Scholarship for Bacteriological Research, Lister Institute of Preventive Medicine, 1910 and 1911.

James C. Philip.

Chapman Jones.

M. O. Forster.

Arthur Harden.

R. V. Norris.

Crowther, Raymond Edwin,
"Edenvale," Wigton Road, Carlisle.

Analytical and Textile Chemist. Author of "Formation of Isatin in the Dyeing of Indigo," *Journal of the Society of Dyers and Colourists*, June, 1911. Former Scholarship Student and present Associate of Municipal School of Technology, Manchester.

E. L. Rhead.

S. J. Peachey.

Edmund Knecht.

F. S. Sinnatt.

Jas. Grant.

Reginald B. Brown.

Dallas, William,
Burnbank Cottage, Mount Vernon, near Glasgow.

Assistant Analytical Chemist, with Messrs. Wm. Beardmore and Co., Ltd., Parkhead Steel Works, Glasgow, in the Armour Plate Department. For seven years with, and latterly Assistant Works

Manager to, the Shettleston Oil and Chemical Co., Ltd., Glasgow, Tar Distillers, Oil Refiners and Coke Manufacturers. For five months Works Chemist to Glengarnock Chem. Co., Ltd., Glengarnock. For one and a-half years, and presently, with Messrs. Beardmore, Ltd., Glasgow, as Assistant Analytical Chemist. Have studied Chemistry, Metallurgy and other subjects, including Bacteriology, at Glasgow Technical College ; and am a Student of the Institution of Mining and Metallurgy.

A. Campion.

T. Cockburn.

G. G. Henderson.

A. D. Gardiner.

Andrew S. Matchet.

Douglas, Robert Percy,

Prudential Buildings, Bolton.

Analytical and Consulting Chemist. Formerly held various positions in chemical laboratories ; acted as Foundry Chemist and Metallurgist, and now in private practice.

Douglas A. MacCallum.

A. Campion.

A. Humboldt Sexton.

Jas. Grant.

E. L. Rhead.

F. S. Sinnatt.

Eastick, Frederick Charles, B.A.,

The Drive, South Woodford.

Analytical Chemist, Martineau's Sugar Refinery. Honours B.A. (Cantab.) (Chemistry, Physics and Botany). Studied at Rostock University, and then spent three months as Volunteer Chemist in Sugar Factory in Germany. Am desirous of keeping in touch with new work, especially on sugars.

W. J. Pope.

John Joseph Eastick.

W. J. Sell.

Chas. E. Eastick.

H. O. Jones.

G. D. Liveing.

Evans, Elliott Alfred,

College of Agriculture, Holmes Chapel.

Demonstrator in Agricultural Chemistry. Student for three years with W. B. Hart, F.I.C., Consulting Chemist ; at present Demonstrator in Agricultural Chemistry. Past student of the School of Technology Manchester.

Edmund Knecht.

F. S. Sinnatt.

S. J. Peachey.

Jul. Hübner.

F. G. Richards.

Jas. Grant.

H. F. Coward.

Farlie, John Burke, Jnr.,

54, Wellington Road, Old Charlton, S.E.

Chemist. Assistant Metallurgist and Chemist, Royal Carriage Dept., Royal Arsenal, Woolwich. Sixteen years pupil and assistant to my father, Mr. J. B. Farlie, Royal Arsenal, Woolwich ; four years' training at Royal Arsenal Technical School. Studied also at Woolwich Polytechnic and Finsbury Technical College.

J. B. Farlie.

H. Russell Pitt.

A. H. Munday.

S. Field.

W. Kellner.

Frankland, Edward Percy,

The Dell, Northfield, Birmingham.

Assistant Lecturer and Demonstrator, University of Birmingham. B.A. (Cambridge); Ph.D. (Würzburg); M.Sc. (Birmingham). Author of four publications in the Transactions of the Chemical Society.

H. J. H. Fenton.

H. O. Jones.

W. J. Sell.

Thomas Purdie.

F. W. Dootson.

Hamilton McCombie.

Percy F. Frankland.

Hawkins, Walter Elmslie,

86, Park Lane, Croydon.

In the employ of a firm of Chemical Manufacturers. B.Sc. (Hons. Chem.) of London University. Three years a Student at the East London College ; engaged in chemical work, and desirous of keeping in touch with the development of Chemistry.

J. T. Hewitt.

F. G. Pope.

Clarence Smith.

A. D. Mitchell.

C. M. Stuart.

Hill, James Grainger,

124, Borneo St., Walsall, Staffordshire.

Analyst. Have been trained in Chemistry for seven years under Frank E. Thompson, Esq., A.R.C.S. Lond., F.I.C., F.C.S., M.R.S.I. ; and for five years under Walter Macfarlane, Esq., F.I.C., in Metallurgy. Have passed 1st Class Stage III Practical Metallurgy, 2nd Class Stage III Practical Chemistry, and 1st Class (Honours) Stage III Iron and Steel, London and City Guilds. Have been in Partnership with Frank Ernest Thompson, F.I.C., F.C.S., practising as Analytical and Consulting Chemist at The Laboratory, Walsall, for almost five years (since March 25, 1907).

Frank E. Thompson.

Harry Essex.

Arthur Adams.

John H. Lavender.

C. Herbert Thompson.

Howells, Oliver Richard,
Bracondale School, Norwich.

Science and Mathematical Master in the above-mentioned school. Day-Student at East London College, 1905-1908 (Registered Internal Student of London University). Studied Chemistry, together with Physics and Mathematics. B.Sc. with 2nd Class Honours in Chemistry, 1908. Two years' training in General Commercial Analytical Chemistry, 1908-1911: (i) One year in laboratory of G. E. Railway, Stratford, London. (ii) One year in laboratory of Messrs. W. Canning & Co., Birmingham. Desire to keep up with recent research.

J. T. Hewitt.

A. D. Mitchell.

Clarence Smith.

J. J. Fox.

Frank G. Pope.

C. Proud.

Hughes, John Owen, B.Sc.,
University College of N. Wales, Bangor.

Assist. Lecturer and Demonstrator in Chemistry. Contributions to Chem. Science: British Association Reports, 1906, 1907, 1908, 1909, 1910, 1911, on the "Composition and Origin of the Crystalline Rocks of Anglesey."

Kennedy J. P. Orton.

Charles T. Heycock.

H. O. Jones.

J. E. Coates.

R. Gaunt.

Jones, Edgar Dingle,
3, Neville Road, Waterloo, near Liverpool.

Analytical Chemist. Twelve months pupil-assistant at Liverpool School of Science (Chemical Dept.); twelve months pupil-assistant to Mr. S. Andrade, B.A., B.Sc. (Camb.), B.Sc. (Lond.); five years apprentice to Chemistry and Manufacture of Sugar and Starch Glucose (Messrs. Freeman Lloyd & Co., Ltd., L'pool); six years, and at present, Chemist to Messrs. Fairrie & Co., Ltd., Sugar Refiners, L'pool.; Derby Science Prizeman, L'pool Technical School.

George Tate.

F. H. Sharpe.

Thomas J. Roberts.

John F. Haws.

Henry Fairrie.

Seymour-Jones, Richard Arnold,
Lyddon Hall, Virginia Road, Leeds.

Research Chemist in the Department of Applied Chemistry of Leather Manufacture. 1st Class B.Sc. Honours; M.Sc., Leeds University; two years' post-graduate research. Original papers on "Acids in Tan Liquors," and "Estimation of Mercuric Salts,"

"Action of Dilute Acids and Salt Solutions on Gelatine," and
 "Tanning Theory," all joint papers with H. R. Procter, M.Sc.

Henry R. Procter.

H. M. Dawson.

J. B. Cohen.

A. G. Perkin.

W. Lowson.

Knox, Archibald,

18, Newhall Terrace, Greenhead, Glasgow.

Analytical Chemist. Certificates gained at Glasgow Royal Technical College: Elementary and Advanced, Practical and Theoretical in the following subjects: Chemistry (Inorganic and Organic), Botany, and Bacteriology; also, Oils and Fats, Materia Medica, and Pharmacy. Experience: Five years with the late Dr. John Clark, City Analyst of Glasgow; three years with the Scottish Co-op. Chemical Dept.; two years, Works Manager with Robt. Young & Co., Chemical Manufacturers, Glasgow; at present in the employ of Messrs. Wm. Beardmore & Co., Ltd., Parkhead Forge, Glasgow.

G. G. Henderson.

A. D. Gardiner.

Thomas Gray.

Andw. S. Matchet.

A. Campion.

T. Cockburn.

Lacey, Edwin Charles,

St. Julian's Lodge, West Norwood, S.E.

Technical Chemist. 1st B.Sc. Edin. Silver Medallist Honours Grade, City and Guilds of London.

R. Meldola.

J. Tcherniac.

Frank E. Weston.

Edward V. Evans.

M. J. A. Braun.

B. H. Buttle.

Lampitt, Leslie Herbert,

Bowyer Road, Saltley, Birmingham.

Research Chemist. B.Sc. of Birmingham, Double First in Chemistry and Biological Chemistry. M.Sc. on result of research work on "Nitrogen Nutrition of Yeast." University Scholar, 1909-10; Research Scholar, 1910-11; Research Work continued, 1911-12.

Percy F. Frankland.

C. K. Tinkler.

Adrian J. Brown.

Thomas H. Pope.

Hamilton McCombie.

J. E. Coates.

Lenfestey, Harold John de Quetteville,

50, Tettenhall Road, Wolverhampton.

Chemical Engineer. Three year Chemical Course under Prof. Armstrong, Central Technical College. Assistant Chemist, Associated Portland Cement Manufacturers, Ltd. Assistant Chemist, Messrs.

Kaye & Co., Ltd., Cement Manufacturers, Southam. Chief Chemist,
Kennicott Water Softener Co. (present position).

Henry E. Armstrong.

Edward Horton.

W. Robertson.

R. T. Colgate.

F. P. Worley.

Lucas, William Thornton,

62, Mowbray Road, South Shields.

Schoolmaster (Science). Open Science Exhibition, Trinity Hall,
Cambridge. Honours B.A. in Science (including Chemistry) at
Cambridge (Nat. Sci. Trip. 1910). Late Science Master at Solibull
Grammar School. Now Science Master at South Shields High
School.

Arthur J. Cooper.

W. A. R. Wilks.

W. J. Pope.

F. W. Dootson.

H. J. H. Fenton.

W. J. Sell.

Menon, Ambat Kesava,

45, York Grove, Peckham, S.E.

Chemist. Bachelor of Arts of Madras. A Member of the Society
of Chemical Industry. Have read a paper on "Some Indian Oils and
Fats" before the Society of Chemical Industry, London, December
1910. Engaged in the manufacture of soaps, etc.

J. Lewkowitsch.

Frank Clowes.

E. Grant Hooper.

E. T. Shelbourn.

J. H. Coste.

E. J. Jackman.

O'Mara, James,

Dunlca, College Road, Dulwich, S.E.

B.A. Royal University of Ireland; scientific training. Director of
Food Manufacturing Companies. Now pursuing chemical research
work in biological chemistry connected with food industries.

Edward Divers

R. H. Aders Plimmer.

Charles Dorée.

J. A. Gardner.

Noel C. Akers.

Milbourne, Robert John, Assoc. M.Inst.C.E.,

Muxton Lodge, near Newport, Salop.

Chemical Engineer to Messrs. C. & W. Walker, Ltd., Midland
Ironworks, Donnington, Newport, Salop. Engaged in designing,
constructing, erecting and starting to work sulphate, liquid, and
muriate of ammonia plants; sulphuric acid, and Claus sulphur plants;
also apparatus for the purification of coal gas and the necessary

analytical work in connexion therewith. Three years' course in Theoretical and Practical Chemistry at the City of London College.

Thos. P. Blunt.

N. H. Humphrys.

W. B. Davidson.

W. H. Pendlebury.

James McLeod.

J. Wilkinson.

A. V. Hendrickson.

Painter, George Macaulay,

"Rosemeade," Thundersley, Essex.

Lecture Demonstrator in Chemistry. Lecture Demonstrator in Chemistry Dept., Birkbeck College; B.Sc. (1st Class Honours in Chemistry) London University.

Alex. McKenzie.

G. H. Martin.

G. W. Clough.

J. H. Allworthy.

G. Martin.

Rennie, John,

"Maisonette," Rufford Park, Yeadon, near Leeds.

Technical Chemist and Manager for Messrs. W. B. Cartwright, Ltd., Manufacturing Chemists, Rawdon. Member of Pharmaceutical Society of Great Britain. Engaged in Technical, Pharmaceutical and Manufacturing Chemistry during the past ten years.

George Clayton.

T. Armistead Ward.

F. Pilkington Sargeant.

Joseph Brierley.

James B. Wilkinson.

Shute, Henry Alfred,

102, Meeting House Lane, Peckham, London, S.E.

Schoolmaster. B.Sc. Lond. (1st Hons. Chem). Formerly student in Sir William Ramsay's Laboratories at Univ. Coll., London. Senior Science Master at Kendal Grammar School, Westmorland.

William Ramsay.

W. C. McC. Lewis.

R. Whytlaw-Gray.

Samuel Smiles.

J. Norman Collie.

Singh, Bawa Kartar,

Dacca, Bengal.

Professor of Chemistry. Residence at Cambridge, 1904-1910. Natural Sciences Tripos, 1906; B.A., 1907; Professor at Dacca College since November, 1910.

E. R. Watson.

W. A. R. Wilks.

W. J. Sell.

F. W. Dootson.

H. O. Jones.

Thompson, Arthur,

Bryn Teg, Chetwynd Road, Wolverhampton.

Works Chemist. Formerly Assistant Chemist to Mr. C. Herbert Thompson, F.C.S., Amblecote Laboratory, Stourbridge; at present

time Chief Chemist in Enamelling Works of Messrs. Joseph Sankey & Sons, Bilston, Staffs. Desires to become a Fellow of the Chemical Society to keep in touch with the latest Chemical Research, and have access to the Library of the Chemical Society.

C. Herbert Thompson.

Edgar Neumann.

William Thomson.

James Porter Shenton.

Herbert William Hart.

Walker, George,

Stonehurst, Lancaster Road, Morecambe, Lancs.

Analytical Chemist. Associate of Royal School of Mines, London (A.R.S.M.). Analytical Chemist, Carnforth Iron Works.

E. O. Courtman.

W. T. Clough.

W. H. Merrett.

F. B. Thole.

A. E. Dunstan.

E. D. Griffiths.

Wallace, Arthur,

1, St. Lawrence Road, Clontarf, Dublin.

Assistant in Chemistry to Prof. of Physiology, T.C.D. B.A. (Dub.). B.Sc. (Lond.), A.I.C. From 1908 to 1910 Demonstrator in Chemistry to Prof. of Chemistry, T.C.D.

Emil A. Werner.

Wm. C. Ramsden.

Sydney Young.

Wm. Caldwell.

Hans Krall.

Wilkins, Charles Reginald,

40, Church Lane, Hornsey, London, N.

Analytical Chemist. B.Sc. (Lond.), 2nd Class Honours in Chemistry, Two years in laboratory of Odams' Manure and Chemical Co. Fourteen years assistant to A. J. de Hailes, Esq., F.I.C., F.C.S. At present Chemist to Co-operative Wholesale Society, Ltd., Silvertown, E. Has also studied at Birkbeck College, Northern Polytechnic Institute, London, N., and Sir John Cass Technical Institute.

A. J. de Hailes.

Charles A. Keane.

Alex. McKenzie.

W. H. Mills.

J. T. Dunn.

The following Certificates have been authorised by the Council for presentation to Ballot under Bye-law I (3):

Chakraborty, Jatindranath, B.A.

Goabagan, Calcutta, India.

Director (technical) to the Oriental Soap Factory, Calcutta. Chimiste Diplômé de l'Université de Paris; (at present) Chemist to

the Oriental Soap Factory, Calcutta. Studied Inorganic Chemistry under M. Moissan and M. Le Chatelier; Organic Chemistry under Dr. Haller and Dr. Bouveaut; Analytical Chemistry under Dr. Urban at the Sorbonne; Biological Chemistry under Dr. Bertrand at the Pasteur Institute; Industrial Chemistry under Dr. Chabrie at the Institut de Chimie Appliquée (Paris), and worked in their respective laboratories.

P. C. Rây.

G. C. Sen.

Jyoti Bhushan Bhaduri.

Thomson, John Scott,

c/o Messrs. Thomson & Co., Crawford St., Dunedin, N.Z.

Chemist, Manufacturer, and Brewer. Analyst to Messrs. Thomson and Co., Mineral Water Manufacturers and Brewers, Dunedin, N.Z., for the last eight years. Studied in laboratory of G. M. Thomson, Esq., M.P., F.C.S., Public Analyst. Making special study of ferments, etc., in connection with brewing. Interested in Chemical Science generally, and am desirous of coming in touch with current scientific literature.

T. May Smith.

B. C. Aston

A. M. Wright.

Whittick, Frederick George,

Imperial Provincial College, Chi-nan-fu, Shantung, China.

Professor of English and Science (Chemistry and Physics). Teacher's Certificate, Board of Education. (Normal College, Bangor, 1895-97.) Student of Chemistry, Tech. School, Blackburn; F.R.G.S., M.R.A.S., Mem. Roy. Soc. Arts.

A. Willoughby-Henzell.

Alfred Tingle.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 401.

Thursday, May 2nd, 1912, at 8.30 p.m., Professor E. J. MILLS,
D.Sc., F.R.S., Vice-President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

Cyril Douglas Birks, Cobnar Gardens, Woodseats, Sheffield.

William Henry Bowater, School of Mines, Charters Towers,
Queensland.

Alfred Varlow Campbell, Rothamsted Experimental Station,
Harpenden.

Bamacharan Chatterji, M.A., Scottish Churches College, Calcutta.

George Cruden Dieffenthaller, 7, Darcueil Lane, Belmont, Port
of Spain, Trinidad.

Leonard Harding, Fern Lea, Russell Street, Eccles.

Harold Heron, 110, Fenchurch Street, E.C.

Thomas John Keenan, 751, East Nineteenth Street, Brooklyn,
U.S.A.

Percival Edward Meadon, B.A., 6, Stanley Road, Oxford.

Eric Keightley Rideal, B.A., 28, Victoria Street, S.W.

Percy Wharton Waters, Glenbervie, Melrose Avenue, Brooklands,
Sale, Manchester.

A Ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

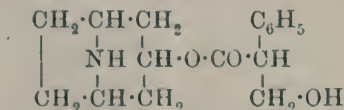
Daniel Arkell, B.Sc.	Richard Arnold Seymour-Jones, M.Sc.
Arthur Leslie Bartow.	Archibald Knox.
Arthur Anderson Bones.	Edwin Charles Lacey, B.Sc.
Ernest Gower Bryant.	Leslie Herbert Lampitt, M.Sc.
Charles Rugeley Bury, B.A.	Harold John de Quetteville Lenfestey.
Jatindranath Chakraborty, B.A.	William Thornton Lucas, B.A.
Evelyn Ashley Cooper, B.Sc.	Ambat Kesava Menon, B.A.
Raymond Edwin Crowther.	Robert John Milbourne.
William Dallas.	James O'Mara, B.A.
Robert Percy Douglas.	George Macaulay Painter, B.Sc.
Frederick Charles Eastick, B.A.	John Rennie.
Elliott Alfred Evans.	Henry Alfred Shute, B.Sc.
John Burke Farlie, jun.	Bawa Kartar Singh, B.A.
Edward Percy Frankland, B.A., Ph.D., M.Sc.	Arthur Thompson.
Walter Elmslie Hawkins, B.Sc.	John Scott Thomson.
James Grainger Hill.	George Walker.
Oliver Richard Howells, B.Sc.	Arthur Wallace, B.A., B.Sc.
John Owen Hughes, B.Sc.	Frederick George Whittick.
Edgar Dingle Jones.	Charles Reginald Wilkins, B.Sc.

Of the following papers, those marked * were read:

- *102. "Nor-hyoscyamine and nor-atropine; alkaloids occurring in various solanaceous plants." By Francis Howard Carr and William Colebrook Reynolds.**

Nor-hyoscyamine—the secondary base corresponding with hyoscyamine—was described, and shown to occur in a number of different species of plants of the natural order Solanaceæ, namely, in *Scopolia japonica*, *Datura metel*, *Datura meteloides*, *Duboisia myoporoides*, and *Mandragora vernalis*, all of which also contain hyoscyamine.

The chemical constitution is expressed by the formula:



which is supported by the evidence: (1) that the alkaloid contains no NMe group; (2) that it forms a nitrosoamine, and therefore contains an :NH group; (3) that methyl iodide reacts with it, forming hyoscyamine; and (4) that it yields by hydrolysis tropic acid and nor-tropanol—a previously known base.

Nor-hyoscyamine is levorotatory, and is racemised by the action of dilute alkali. The racemic base, nor-atropine, gives atropine on

methylation with methyl iodide. It therefore bears the same relation to atropine as nor-hyoscyamine does to hyoscyamine.

The properties of these two new alkaloids and their salts were described. Evidence was given to prove that the supposed isomeride of hyoscyamine, called ψ -hyoscyamine, described by Merck, is in reality nor-hyoscyamine.

The best method of distinguishing nor-hyoscyamine and nor-atropine from each other and from the other mydriatic alkaloids, is by the melting points and crystalline form of various salts, particularly the oxalates, aurichlorides, and picrates.

Nor-hyoscyamine and nor-atropine produce contraction of the pupil of the eye of the cat, but the activity is about one-eighth that of the corresponding *N*-methyl derivative.

***103. "Researches on the constitution of physostigmine. Part I."**
By Arthur Henry Salway.

Physostigmine, when distilled with zinc dust, yields a mixture of 1- and 2-methylindoles. The author concludes that physostigmine contains a benzene nucleus attached to nitrogen, whilst it is not improbable that the atomic grouping, $C_6H_4<\underset{N}{C}>C$, is also present in the alkaloid.

The hydrolytic product of physostigmine, namely, eseroline, $C_{13}H_{18}ON_2$, first prepared by Ehrenberg in 1893, has been found to be a monacidic tertiary base, containing one methyl group attached to nitrogen. Its *hydrochloride*, *picrate*, and *methiodide* were described.

The oxidation products of physostigmine and eseroline have also been investigated. The so-called "eserine blue" has now been isolated in a pure condition. This base, $C_{17}H_{23}O_2N_3$, yields crystalline salts with two equivalents of an acid. It has an intensely blue colour, and in the presence of acids shows a brilliant carmine-red fluorescence.

When physostigmine or eseroline is allowed to absorb two atoms of oxygen in the presence of alkalis, rubreserine, $C_{13}H_{16}O_2N_2$, is formed. This substance, previously isolated by Eber (*Pharm. Zeit.*, 1888, **33**, 611), has been re-examined. It is a neutral substance, but yields salts both with acids and bases. Its *aurichloride*, *hydrochloride*, *picrate*, and *silver* salt were described.

- *104. "The resolution of benzoylalanine into its optically active components." By William Jackson Pope and Charles Stanley Gibson.

The equilibrium method of Pope and Peachey can be conveniently applied in the resolution of externally compensated benzoylalanine into its optically active components. The rotation constants of *d*- and *l*-benzoylalanine have been determined in a number of solvents for mercury-green, mercury-yellow, and sodium light.

105. "The 'true' ionisation and hydration constants of ammonia and some amines, with a note on the formulation of nitrogen compounds." By Tom Sidney Moore.

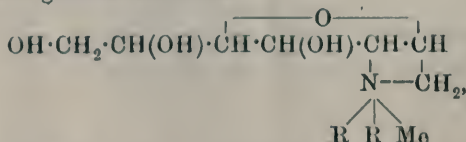
The author has applied the method of calculation previously described by him (*Trans.*, 1907, **91**, 1373) to the results of the measurements of the partition-coefficients and "apparent" ionisation constants of ammonia, the methylamines, the ethylamines, and primary and secondary propylamines carried out by Winmill (this vol., p. 109). The results do not bring to light any simple relation between the constitution of an amine and the value of its ionisation constant and hydration constant, but show that there is a great contrast in ionising power between the quaternary hydroxides and the hydroxides of primary, secondary, and tertiary amines.

A modification of Werner's theory of ammonium compounds has been proposed to explain the observed relations.

106. "The conversion of *d*-glucosamine into *d*-glucose."
By James Colquhoun Irvine and Alexander Hynd.

The essential results of this investigation have already been published in a preliminary note (*Proc.*, 1912, **28**, 54).

It has now been found that α -aminomethylglucoside and its *N*-alkyl homologues, which are obtained as intermediate compounds in the conversion of glucosamine into glucose, are not to be regarded as simple glucosides. The reactions of the free bases are best explained by the general structure:



where R = the methyl group or hydrogen. It was also shown that

many of the reactions of glucosamine may be explained in terms of a formula of the above type.

The possibility of the conversion of glucosamine into glucose being accompanied by a Walden inversion was discussed, and reasons were given for the conclusion that a structural change of this nature does not take place. Glucosamine may thus be regarded as α -amino-*d*-glucose.

107. "The chlorination of iodophenols. Part I. The chlorination of *p*-iodophenol." By Sidney Albert Brazier and Hamilton McCombie.

When an ice-cold solution of *p*-iodophenol in carbon tetrachloride is saturated with chlorine, an iodo-dichloride separates, which decomposes with evolution of hydrogen chloride, and the formation of 2-chloro-4-iodophenol. This compound, in turn, when chlorinated, yields an unstable iodo-dichloride, which, on decomposition, furnishes 2:6-dichloro-4-iodophenol. In a similar way, 2:3:6-trichloro-4-iodophenol and 2:3:5:6-tetrachloro-4-iodophenol can be obtained.

In contradistinction to the free phenols, the acetyl and the benzoyl derivatives yield extremely stable iodo-dichlorides, which have been prepared and analysed. There is one exception to this, namely, the acetyl derivative of *p*-iodophenol, the iodo-dichloride of which decomposes after being kept for ten days.

When a solution of *p*-iodophenol in carbon tetrachloride kept at a temperature of 50—60° is saturated with chlorine, there are obtained 2:3:5:6-tetrachloro-4-iodophenol, pentachlorophenol, 2:3:4:4:5:6-hexachlorocyclohexadienone (Zincke and Schaum, *Ber.*, 1894, **27**, 546), and chloroanil.

It was found that no iodo-dichloride could be prepared when the two ortho-positions relative to the iodine atom were occupied by chlorine atoms. This is in agreement with the observations of Willgerodt (*Ber.*, 1910, **43**, 2755; *Annalen*, 1911, **385**, 351).

Another interesting case of steric hindrance was encountered in attempting to prepare the benzoyl derivatives of phenols in which the two ortho-positions relative to the hydroxyl group were occupied with chlorine atoms. The ordinary Schotten-Baumann reaction failed in these cases, but the pyridine method yielded quite satisfactory results.

108. "The monohalogen derivatives of acenaphthene."

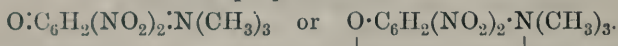
By Holland Crompton and Maggie Walker.

The preparation and some of the physical properties of chloro-, bromo-, and iodo-acenaphthene were described. The melting points

of mixtures of these compounds with each other, and also of their mixtures with acenaphthene, have been determined. Chloro- and bromo-acenaphthene form isomorphous mixtures, but there is no indication of the formation of such mixtures in any of the other cases.

109. "Quinone-ammonium derivatives. Part I. The methylation products of picramic and isopicramic acids." By Raphael Meldola and William Francis Hollely.

The product of extreme methylation of isopicramic acid by methyl sulphate in presence of alkali described in a preliminary note published in 1910 (*Proc.*, **26**, 232) has been studied in detail, and its composition as a trimethyl derivative confirmed. The production of a similar compound from picramic acid has also been observed. Full consideration of the possible formulæ for these compounds has led to the conclusion that they are nitro-derivatives of the hypothetical quinone-ammonium type, $C_6H_4 \begin{smallmatrix} O \\ \diagup \\ NH_3 \end{smallmatrix}$ or $C_6H_4 \begin{smallmatrix} O \\ \diagup \\ \diagdown \\ NH_3 \end{smallmatrix}$, the trimethyl derivatives of which were prepared by Griess in 1880 (*Ber.*, **13**, 246 and 647). This has been proved by the synthesis of the new nitro-derivatives by the direct nitration of Griess's compounds. The formulæ proposed are:



Alternative formulæ in which one of the nitro-groups assumes the "aci"-form have also been considered, and the question of internal linking is for the present left undecided. The compound from isopicramic acid forms a scarlet hydrate, which becomes ochreous on drying owing to conversion into the quinone-ammonium derivative. The authors have discussed in a preliminary way the connexion between the colour and chemical constitution of these compounds, and have arrived at the conclusion that the red hydrate has the structure of a "quinole."

110. "Latent heats of vaporisation of mixed liquids. Part III. Mixtures of associated with non-associated liquids. New criteria for the detection of solvates in mixtures of liquids." By Daniel Tyrer.

In continuation of previous work, the latent heats of mixed liquids have been determined in the following cases: (1) Benzene and ethyl alcohol, (2) chloroform and methyl alcohol, (3) chloroform and acetone, (4) carbon tetrachloride and ethyl alcohol.

In each case one of the constituents is an associated liquid. In addition, determinations have been made of the boiling points of the mixtures and the compositions of the mixed saturated vapours. It was found that case (3) gives a maximum boiling point, and the other three cases all give minimum boiling points. At these maximum and minimum points the curves for the latent heats at constant pressure and constant composition intersect. By the aid of the additive law of mixtures, which was previously shown to be approximately true for latent heats, the apparent latent heats of the associated constituents in each mixture have been calculated. It was found that, as the concentration of the associated constituent diminishes, its apparent latent heat, instead of gradually diminishing as would be expected as a result of the progressive dissociation of the associated molecules, in all cases increases, at least over a portion of the range.

This was shown to be clear indication of the existence of solvates in these mixtures.

111. "Nickelo- and palladio-dithio-oxalic acids."

By Humphrey Owen Jones and Charles Stanley Robinson.

The highly coloured and stable complex salts derived from the dibasic acids, nickelo- and palladio-dithio-oxalic acids, were described in a former paper (*Trans.*, 1912, 101, 62). These two acids have now been isolated and examined.

Nickelodithio-oxalic acid, $\text{Ni}(\text{COS})_4\text{H}_2\cdot 4\text{H}_2\text{O}$, separates from aqueous solutions in lustrous, black prisms often exceeding 1 centimetre in length. Solutions of the acid have higher electrical conductivities than equivalent solutions of sulphuric acid. The acid decomposes in solution at 100° to give four gram-molecules of hydrogen sulphide and one of nickel oxalate from one gram-molecule of the acid, together with oxalic acid, carbon monoxide, and carbon dioxide in variable proportions, the sum of the oxalic acid and carbon monoxide being one gram-molecule.

Palladiodithio-oxalic acid, $\text{Pd}(\text{COS})_4\text{H}_2\cdot 3\text{H}_2\text{O}$, separates from concentrated aqueous solutions in small, dark brown plates. It is a strong acid, but is less stable than the corresponding nickelo-acid.

112. "Dithiomalonates."

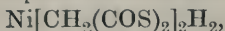
By Humphrey Owen Jones and Charles Stanley Robinson.

By the action of potassium hydrosulphide on amyl dithiomalonate in alcoholic solution, potassium dithiomalonate, $\text{CH}_2(\text{COS})_2\text{K}_2$, is obtained. This salt reacts with metallic salts in a very similar

manner to potassium dithio-oxalate, and with aniline hydrochloride yields malonanilide and hydrogen sulphide.

The colour of the complex nickelodithiomalonate is perceptible at a dilution of 1 part of nickel in 4,000,000 of water, whilst that of the corresponding dithio-oxalate is perceptible at dilutions of 1 in 40,000,000.

Several salts of the complex nickelodithiomalonic acid,



and palladiodithiomalonic acid, $\text{Pd}[\text{CH}_2(\text{COS})_2]_2\text{H}_2$, were described.

113. "The 'crude fat' of *Beta vulgaris*."

By Allen Neville.

The ethereal extract of the dry matter of the common mangel was examined and found to contain triglycerides, free fatty acids, and two neutral substances. The free and combined fatty acids consisted largely of palmitic, oleic, and erucic acids, whilst the two neutral substances were of phytosterol nature, and gave results on analysis corresponding with the empirical formulæ $\text{C}_{31}\text{H}_{58}\text{O}_2$ and $\text{C}_{29}\text{H}_{45}\text{O}_2$ respectively.

114. "An experimental investigation of the bleaching process.

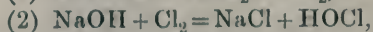
Part II. The action of neutral salts on bleaching solutions."

By Sydney Herbert Higgins.

The author showed that chlorides of sodium and calcium stimulate the bleaching actions of chlorine-water and of hypochlorous acid, as well as that of hypochlorite solutions. In all cases the action is precisely the same; it is an immediate one, after which action the solutions behave as though the chlorides had not been added. These observations are opposed to the representation of the bleaching action of hypochlorites in the presence of chlorides as being due to the development of chlorine according to the equation:



for this explanation does not account for the observations on the other bleaching solutions, and if it were true one would expect sodium chloride to cause a steady acceleration (and not a sudden action) as long as any sodium hypochlorite remained in solution. The reversible actions:



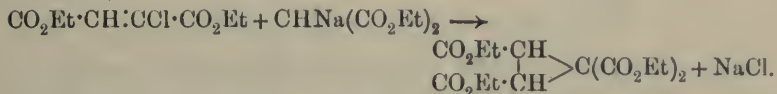
were found to explain all observations, including the behaviour of bleaching powder solution with neutral chlorides. The bleaching

trials were performed on weak solutions of dyestuffs, and on the colouring matters of cotton and linen cloth. In all cases practically the same results were obtained, showing that the same chemical actions took place during the oxidation of all the colouring matters used. The action of carbon dioxide on bleaching powder was discussed from equation (2) in support of the author's previous statement (*Trans.*, 1911, **99**, 858). Solutions of neutral salts were also found to decrease the stability of solutions of potassium permanganate in air and to increase their bleaching effect, so that for permanganate solutions, as for hypochlorites, it is evident that instability and bleaching effect are related.

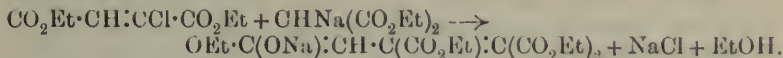
115. "The chemistry of the aconitic acids." (Preliminary note.)

By Norman Bland and Jocelyn Field Thorpe.

A general method for the preparation of aconitic acid and of its alkyl derivatives has been found in the condensation of ethyl chlorofumarate and the sodium compound of ethyl malonate. Under ordinary conditions this condensation leads to the production of ethyl *cyclopropanetetracarboxylate*, thus (Ruhemann, *Trans.*, 1902, **81**, 1212):

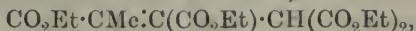


but in the presence of excess of sodium ethoxide ring-formation is prevented, and the yellow sodium compound of ethyl carbethoxyaconitate is produced:



The sodium compound is not dissociated by water, and the aqueous solution yields the free ester when treated by carbon dioxide. From the fact that the ester is completely extracted by alkali from its solution in ether and gives a red coloration with ferric chloride, it follows that it is probably entirely enolic in structure. When hydrolysed by acids it is converted into aconitic acid.

The action of methyl iodide on the sodium compound produces ethyl carbethoxy- γ -methylaconitate (compare Ruhemann, *loc. cit.*, p. 1213), an ester which can be isolated in its structurally distinct ketonic and enolic forms. The *keto*-form,

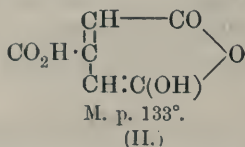
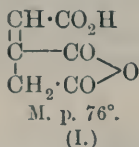


boils at 215°/18 mm., gives no coloration with ferric chloride, and is not extracted from its solution in ether by aqueous alkali. The *enol*-form, $\text{CO}_2\text{Et}\cdot\text{CMe}\cdot\text{C}(\text{CO}_2\text{Et})\cdot\text{C}(\text{CO}_2\text{Et})\cdot\text{C}(\text{OH})\cdot\text{OEt}$, is an oil which is stable at the ordinary temperature, but passes slowly back

to the ketonic modification on distillation. It gives a red coloration with ferric chloride, and is extracted from its ethereal solution by alkali.

It is hoped that by this method alkylated and dialkylated derivatives of aconitic acid can be prepared, and that a comparison of these substances with the corresponding derivatives of glutaconic acid will supply important evidence respecting the influence exerted by the carboxyl group on the β -carbon atom of the three-carbon system.

Aconitic acid is a remarkable example of the different effect produced by a pure and an impure reagent on the course of a reaction. When treated with acetyl chloride containing phosphorus trichloride [Kahlbaum's acetyl chloride (II)], it is quickly converted into the anhydro-acid (I), melting at 76° , as found by Anschütz and Bertram (*Ber.*, 1904, **37**, 3967). If, however, pure acetyl chloride is used, dehydration takes place more slowly, and the product is the hydroxy-anhydro-acid (II):



The hydroxy-anhydro-acid crystallises from ethyl acetate in needles which melt at 133° . It behaves on titration as a dibasic acid, and gives a deep reddish-brown coloration with ferric chloride. It is probable that the anhydro-acid melting at 95° (Easterfield and Sell, *Trans.*, 1892, **61**, 1009) is a mixture of the two anhydrides mentioned above. The anhydro-acid melting at 76° is converted into the hydroxy-anhydro-acid melting at 133° by the action of acetyl chloride.

ADDITIONS TO THE LIBRARY.

1. Donations.

Auld, *Samuel James Manson*. An introduction to quantitative analysis. London 1912. pp. x + 215. ill. 5s. (*Recd.* 3/5/12.)

From the Publishers: Messrs. Methuen and Co., Ltd.

Hampshire, *Charles H.* Volumetric analysis for students of pharmaceutical and general chemistry. London 1912. pp. vii + 104. ill. 3s. 6d. net. (*Recd.* 26/4/12.)

From the Publishers: Messrs. J. & A. Churchill.

Molinari, Ettore. Trattato di chimica organica generale e applicata all'industria. 2nd edition. Milano 1912. pp. xxiv. + 1087. ill. L.18. (*Recd.* 26/4/12.) From the Publisher: Ulrico Hoepli.

Tables annuelles de constantes et données numériques de chimie, de physique et de technologie. Publiées sous le patronage de l'Association internationale des Académies par le Comité international nommé par le VII^e Congrès de Chimie appliquée (Londres, 2 Juin, 1909). Volume I. Année 1910. Paris 1912. (*Reference.*) pp. xxxix + 727. From the International Committee.

Thole, Ferdinand Bernard. Qualitative organic analysis. London 1912. pp. x + 68. ill. 1s 6d. (*Recd.* 3/5/12.)

From the Publishers: Messrs. Methuen and Co., Ltd.

III. Pamphlets.

Schmidt, Ernst. Ueber die Polysulphhydrate des Brucins. (From the *Apoth. Zeit.*, 1911.)

Steinmann, A. Etude critique sur les essais de platine. (From the *J. suisse chim. phys.*, 1911.)

Willard, J. T., and Swanson, C. O. The baking qualities of flour. (From the *Chem. Phys. Papers Kansas Acad. Sci.*, [1911].)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 3rd, 1912.

All persons who received grants in June, 1911, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Saturday, June 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is applied to investigations relating to problems connected with the coal-tar and allied industries.

ERRATA.

PROCEEDINGS, 1912.

Page 77, line	5 from top,	for " March 25th "	read " March 28th. "
„ 94 „ 12 „ „	„	„ "ethyl" read "methyl."	
„ 94 „ 22 „ „	„	„ "tetramethyl" read "octamethyl."	
„ 98 „ 15 from below,	for " Part I "	read " Part VI. "	
„ 101 „ 10 „ „	„	„ " $\text{CH}\cdot\text{CH}_3$ " read " $\text{CH}\cdot\text{CCl}_3$."	

The next Ordinary Scientific Meeting will be held on **Thursday, May 16th**, at **8.30 p.m.**, when the following papers will be communicated:

"Azo-dyestuffs of the triphenylmethane group." By A. G. Green and R. N. Sen.

"Aniline black and allied compounds. Part II." By A. G. Green and A. E. Woodhead.

"Action of Grignard reagents on esters of dibasic acids. (Preliminary note.)" By J. T. Hewitt and D. B. Steinberg.

"Chemical examination of the bark of *Euonymus Atropurpureus*." By H. Rogerson.

"The constitution of aminotyrosine and the action of oxydases on some tyrosine derivatives." By C. Funk.

"Furan-2:5-dialdehyde." By W. F. Cooper and W. H. Nuttall.

"The dynamic isomerism of ammonium thiocyanate and thio-carbamide." By W. R. G. Atkins and E. A. Werner.

"The distillation and densities of mixtures of allyl alcohol and water. Part I." By T. A. Wallace and W. R. G. Atkins.

"A modification of the Beckmann apparatus by which constant readings are obtained in determining the boiling points of aqueous solutions." By E. Knecht and J. P. Batey.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 402.

Thursday, May 16th, 1912, at 8.30 p.m., Dr. M. O. FORSTER,
F.R.S., Vice-President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

Arthur Fred Campbell, M.Sc., Westwood, Middleton, Manchester.

Leslie Melville Clark, 3, Harley Road, Hampstead, N.W.

Bhupati Nath Das, M.A., B.Sc., Wari, Dacca, Eastern Bengal.

Gerard Irvine Davys, Capt. I.M.S., B.A., M.D., B.Ch., Beechview,
Kidbrook Grove, Blackheath, S.E.

Donald M. Fergusson, c/o Acadia Sugar Refining Co., Ltd.,
Halifax, Nova Scotia.

Harold Hartley, M.Sc., Fernbank, Little Switzerland, Douglas,
I. of M.

Henry Medley Hatherly, 14, Stackpool Road, Southville, Bristol.

Max Henius, Ph.D., 1135, Fullerton Avenue, Chicago, Ill.,
U.S.A.

Edward Lewis James, Holly Lodge, Larkhall Rise, Clapham, S.W.

William Jewell, 44, Highfield Road, Dartford, Kent.

Frederick James Meister, 1, Stanley Terrace, Alva.

Robert Charles Menzies, 27, Cluny Drive, Edinburgh.

Sidney Morgan, Rubber Growers' Association Laboratory,
Pataling, Kuala Lumpur, F. M. States.

George Ernest Pearson, Prospect Cottage, Sutton, nr. Hounslow.

William Daveridge Hamilton Shaw, B.Sc., c/o Coppée Coke Oven Co., Ltd., King's House, Kingsway, W.C.

William Thévenaz, D. és Sc., 48, Grey Street, Hull.

William Leonard Thomas, 10, Victor Road, Bradford.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Chatindra Mohan Dutta, M.A., Dacca College, Dacca, India.

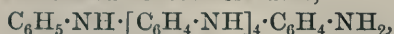
Anakul Chandra Sircar, M.A., Dacca College, Dacca, India.

Of the following papers, those marked * were read:

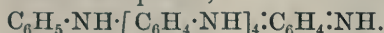
***116. "Aniline-black and allied compounds. Part II."**

By Arthur George Green and Arthur Edmund Woodhead.

Willstätter and Cramer (*Ber.*, 1911, **44**, 2162) have advanced the view that the product of reduction of emeraldine or nigraniline with titanium trichloride or phenylhydrazine in the cold is not as the authors have stated leucoemeraldine,



but the mono-quinonoid compound,



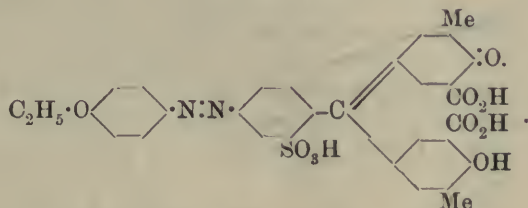
Such a view is improbable in face of the fact that the base is practically colourless, but in order to remove all doubt the compound has been subjected to the action of boiling titanium trichloride in an atmosphere of carbon dioxide. The compound remained unaltered, and only a slight change in the titre of the titanium trichloride (due to air oxidation) occurred.

It must therefore be concluded that the base is actually the leuco-compound, and does not contain a quinonoid group. The true mono-quinonoid compound (protoemeraldine) was prepared by reduction of emeraldine with sulphurous acid. It is a violet base forming yellowish-green salts, and dissolves in 80 per cent. acetic acid with a grass-green colour. These observations confirm the previous conclusions of the authors as to the number of quinonoid groups in the primary oxidation products of aniline. The "aniline-blacks" of Willstätter and Dorogi are mixtures of these primary products with polymerised derivatives, due to the action of the mineral acid used in purification, and cannot be regarded as identical with the true aniline-black formed on the fibre.

*117. "Azo-dyestuffs of the triphenylmethane group."

By Arthur George Green and Rajendra Nath Sen.

With the object of ascertaining the effect on the colour exerted by two chromophors, the azo-group and the carbinol group present in the para-position with respect to each other, the authors have prepared a series of azotriphenylmethane and azotriphenylcarbinol dyestuffs by condensing azoaldehydes, such as phenetoleazobenzaldehydesulphonic acid, $\text{OEt} \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{C}_6\text{H}_3(\text{SO}_3\text{H}) \cdot \text{CHO}$, with 2-hydroxytoluic and salicylic acids. The condensation occurs readily in cold concentrated sulphuric acid solution, giving azotriphenylmethane derivatives, which by reason of the presence of the azo-group are yellow dyestuffs. On oxidation with nitrosyl sulphate they are converted into azotriphenylcarbinols, as, for example, the compound



The latter are well defined polygenetic dyestuffs, dyeing wool directly in red shades, and producing various colours with different metallic mordants. The chromium lakes, which are black, can also be produced on the wool fibre by dyeing with the azotriphenylmethane dyestuffs, and then boiling the wool with an acidified solution of sodium dichromate, when both oxidation and combination with chromium occur together, and the colour changes from yellow through maroon to black.

The conclusion is drawn that the colour of these dyestuffs is an additive effect produced by the two chromophors acting separately.

*118. "Investigations on the dependence of rotatory power on chemical constitution. Part III. The rotatory powers of *ac*-tetrahydro-2-naphthol and some of its esters." By Robert Howson Pickard and Joseph Kenyon.

ac-Tetrahydro-2-naphthol has been resolved into its optically active components by the fractional crystallisation from acetone of the *brucine* and *cinchonidine* salts of the *hydrogen phthalic ester*. The active alcohols have a considerably higher rotatory power ($[\alpha]_D \pm 67.2^\circ$ in 5 per cent. chloroform solution) than that previously given (Pickard and Littlebury, *Trans.*, 1906, **89**, 1254), and

crystallise very readily from light petroleum in long needles which melt at 50°.

A series of esters of the active alcohols with normal fatty acids (acetic to lauric) has been prepared. The values of the molecular rotatory powers of these gradually diminish from the propionate until the nonoate term is reached, after which the value increases. In close agreement with these results are the determinations of the effect of temperature on the rotatory power of these esters. The *acetate* with $[M]_D^{20}$ 109.2°, *propionate* with $[M]_D^{20}$ 116.2°, *n-valerate* with $[M]_D^{20}$ 113.7°, *n-heptoate* with $[M]_D^{20}$ 111.5°, and the *n-nonoate* with $[M]_D^{20}$ 102.0° were obtained as viscid oils at the ordinary temperature, whilst the *laurate* with $[M]_D^{20}$ 107.9° solidifies to a crystalline mass and melts at 36°.

DISCUSSION.

Dr. A. E. DUNSTAN pointed out that it would be possible, by means of viscosity determinations, to find out whether the mixture of the *d*- and *l*-tetrahydronaphthols was a racemic mixture or a true compound, seeing that the melting points of the optical antipodes were low enough to enable measurements to be made in the liquid state.

*119. "Chemical examination of the bark of *Euonymus atropurpureus*." By Harold Rogerson.

A description was given of a complete examination of the root-bark of *Euonymus atropurpureus*, Jacquin (Nat. Ord. *Celastraceae*). The new substances which have been isolated and characterised comprise a new crystalline acid, *furan-β-carboxylic acid*, $C_5H_4O_3$ (m. p. 121—122°); a new crystalline alcohol designated *euonymol*, $C_{21}H_{30}O_4$ (m. p. 248—250°), and a series of new alcoholic substances which give colour reactions similar to the phytosterols, and have been designated *euonysterol*, $C_{31}H_{51}O \cdot OH$ (m. p. 137—138°), *homo-euonysterol*, $C_{40}H_{69}O \cdot OH$ (m. p. 133—134°), and *atropurol*, $C_{27}H_{44}(OH)_2$ (m. p. 283—285°) respectively.

Various other definite substances have also been isolated and identified, amongst which may be mentioned dulcitol, $C_6H_{14}O_6$; citrullol, $C_{22}H_{36}O_2(OH)_2$; and a mixture of fatty acids. No evidence was obtained of the presence of a glucoside in the bark.

DISCUSSION.

Mr. FINNEMORE asked if the substance euonymol obtained in small quantities from the aqueous extract had been tested pharma-

cologically. Seeing that the drug had been shown by Meyer to contain a heart poison, it seemed to be of some interest, as euonymol appeared to give the same colour reactions as cynotoxin, the heart poison obtained from *Apocynum*.

Mr. ROGERSON, in reply to Mr. Finnemore, stated that euonymol had not been physiologically tested; and in reply to Dr. Harden said that *Euonymus atropurpureus*, Jacquin, was a good source of dulcitol, the yield being equivalent to 2.09 per cent. of the weight of root-bark taken.

*120. "Furan-2:5-dialdehyde."

By William Francis Cooper and Walter Harold Nuttall.

In the preparation of dehydromucic acid by the oxidation of ω -chloromethylfurfuraldehyde with nitric acid, a considerable quantity of furan-2:5-dialdehyde is produced if the reaction is retarded by cooling. A small quantity of a crystalline acid (m. p. 196—197°), probably furan-2-aldehyde-5-carboxylic acid (pyromucic aldehyde), is also formed.

Furan-2:5-dialdehyde is a white, crystalline compound melting at 109.5—110°, which on oxidation gives dehydromucic acid. It is characterised by the blue colour which it gives with thymol and excess of sulphuric acid.

The *diphenylhydrazone* (m. p. 206—207°), *dioxime* (m. p. 212.5—213°), *dianilide* (m. p. 160—161°), and β -*naphthylamine* derivative (m. p. above 230°) were described.

The dialdehyde is also formed in the retarded oxidation of ω -hydroxymethylfurfuraldehyde with nitric acid. ω -Hydroxymethylfurfuraldehyde is most conveniently prepared by pouring crude ω -chloromethylfurfuraldehyde into a large excess of almost boiling water, without the presence of any reagent capable of reacting with the liberated hydrogen chloride (namely, silver nitrate or barium carbonate) as recommended hitherto.

β -Naphthylamine is a very convenient reagent for the identification of aldehydes of the furan series.

The β -*naphthylamine* derivatives of methylfurfuraldehyde (m. p. 87—88°) and ω -hydroxymethylfurfuraldehyde (m. p. 131—132°) were described.

*121. Researches on santalin. Part I. Santalin and its derivatives."

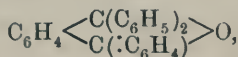
By John Cannell Cain and John Lionel Simonsen.

The authors have examined the saplings of *Pterocarpus santalinus* (red sanderswood), and have investigated the colouring matter, santalin, contained in the wood of the tree.

The colourless saplings contain free sugar and a *glucoside*, which on hydrolysis decomposes into a *phlobaphen* and dextrose. Santalin, whether obtained from the wood as grown in India, from the rasped wood imported into England, or from the commercial dyestuff, has the formula $C_{15}H_{14}O_5$, and melts at 226° . It forms *diacetyl*, *nitro-diacetyl*, and *dibenzoyl* derivatives, and the *nitro*- and *benzeneazo*-derivatives have been prepared, as well as the *oxime* and *dimethyl ether* and its *nitro*-derivative. Oxidation of the dimethyl ether furnishes veratric and anisic acids, and the nitrodimethyl ether when oxidised yields anisic acid and probably a nitroveratric acid.

122. "Action of Grignard reagents on esters of dibasic acids."
(Preliminary note.) By John Theodore Hewitt and David Bernard Steinberg.

By the action of magnesium phenyl bromide on diethyl phthalate, Shibata (*Trans.*, 1909, **95**, 1449) obtained a compound of the formula $C_{26}H_{18}O$, melting at 194 — 195° , to which he assigned the constitution :



Certain theoretical conclusions as to the nature of the benzene nucleus were based on the assumption that the compound contained the phenylene group attached to a single carbon atom.

Following Shibata's directions, a compound is obtained identical with diphenylanthrone synthesised by Haller's method from phenyl-oxanthronyl chloride and benzene in presence of aluminium chloride, as shown by appearance, solubilities, and mixed melting point, 193° . Shibata's observation that the compound is stable towards bromine and potassium permanganate is thus readily explained.

123. "The constitution of aminotyrosine and the action of oxydases on some tyrosine derivatives." By Casimir Funk.

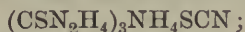
An attempt has been made to prepare an optically active 3:4-dihydroxyphenylalanine by the action of nitrous acid on aminotyrosine, which was considered to be 3-aminotyrosine. In this way an optically inactive compound was isolated, which possessed the composition of the initial product, but differed from the latter in the colour of the crystals, melting point, and behaviour towards oxydases.

It was concluded therefore that aminotyrosine is a mixture of

2- and 3-aminotyrosine, the product obtained being 2-aminotyrosine. Further, the action of laccase and tyrosinase on amino- and hydroxy-tyrosine and adrenaline was tested, and it was found that both ferments are able to oxidise these substances.

124. "The dynamic isomerism of ammonium thiocyanate and thiocarbamide." By William Ringrose Gelston Atkins and Emil Alphonse Werner.

A careful study of the freezing points of mixtures of the two isomerides at temperatures above 130° shows a deviation from the simple form of the freezing-point composition diagram given by Findlay (*Trans.*, 1904, **84**, 403). Evidence has been obtained indicating the presence in the fusion of the compound



this undergoes dissociation, even below its apparent melting point (144°).

The form of the curve obtained clearly shows that the true melting point of thiocarbamide itself lies at about 200° ; the very rapid reversion which takes place before this temperature can be reached renders its experimental realisation impracticable. The reversion has also been studied in aqueous and in alcoholic solution; the results obtained in the former case confirm the work of Dutoit and Gagnaux (*J. Chim. phys.*, 1906, **4**, 261).

Values were given for the velocity constant of the reversion of ammonium thiocyanate in the liquid phase; the mean value of K_1 is 0.00295, as compared with $K_1 = 0.00633$ found by Waddell (*J. Physical Chem.*, 1898, **2**, 525).

The series of tetrathiocarbamide alkali iodide compounds has been completed by the preparation of the rubidium and caesium derivatives, $(\text{CSN}_2\text{H}_4)_4\text{RbI}$ (m. p. 202°) and $(\text{CSN}_2\text{H}_4)_4\text{CsI}$ (m. p. 191°).

Lithium and sodium iodides do not form any compounds with thiocarbamide.

The compound $(\text{CSN}_2\text{H}_4)_4\text{KI}$ has already been described (Werner, *Proc.*, 1906, **22**, 245).

Thiocarbamide and potassium thiocyanate unite to form the compound $(\text{CSN}_2\text{H}_4)_3\text{KSCN}$ (m. p. 143°), analogous to the above ammonium compound.

125. "Properties of mixtures of allyl alcohol and water. Part I." By Thomas Arthur Wallace and William Ringrose Gelston Atkins.

In order to be able to analyse accurately the mixtures of the alcohol with water during the subsequent work, a complete density-

composition diagram was plotted for 0° . Analysis may also be satisfactorily carried out by a slight modification of the bromine absorption method. A large contraction in volume was found, amounting to 2.54 per cent. with a mixture containing 39 per cent. of alcohol when determined at 0° . The pure alcohol had D_0° 0.86929 and boiling point 96.95° . The alcohol and water afford a binary mixture of constant boiling point, as already known. The composition of this is 72 per cent. of alcohol and 28 per cent. of water, and its boiling point is 88.0° . In determinations of the above composition, the middle-point distillation method of S. Young gave values which agreed closely with those obtained from the density curve. The behaviour of the alcohol on distillation with benzene and water is at present under investigation.

126. "A modification of the Beckmann apparatus."

By Edmund Knecht and John Percy Batey.

The authors find that by employing a heating coil of suitable resistance, internal electrical heating can be used in the Beckmann apparatus for determining the molecular weight of substances in aqueous solution without electrolysis taking place. Quite constant readings are obtained without any special precautions. The apparatus has been used for determining the molecular weights of certain dyestuffs, such as benzopurpurine and indigo-white.

127. "Alkaline cupri-compounds."

By Spencer Umfreville Pickering.

Twenty-four cupri-compounds of tartaric and racemic acids were described, representable by ten general formulæ, derived either from a molecule of the copper salt or of the double salt of copper and the alkali metal, by the copper atom becoming quadrivalent, and the introduction of OH, OM', or O_2Cu'' groups through the action of alkali. Four of the salts are represented by the empirical formula $(R_2CuM'_2)_3, 5CuO$; in the others, which are alkaline in reaction, the ratio of copper to alkali metal is 1:1, 1:2, 1:2.5, 1:3, 1:4, 1:5, and 1:6. All the compounds except those with the ratio 1:1 are crystalline. Copper racemate itself exists in two different forms, one of which is probably a "cupri"-salt, and is much more soluble than the ordinary racemate.

128. "The constituents of West Indian satinwood."

By Samuel James Manson Auld and Samuel Shrowder Pickles.

An investigation of West Indian satinwood (*Zanthoxylum flavum*, Vahl.; *Fagara flava*, Kr. et Urb.) has been made, the primary object of which was to determine whether it contained irritating or poisonous principles, such as have already been shown to be present in East Indian satinwood (Auld, *Trans.*, 1909, **95**, 964). The examination has shown it to contain several interesting compounds of a lactonic character, together with a number of non-crystalline resins. These include a colourless, crystalline compound, $C_{11}H_{10}O_3$ (m. p. 124—126°), and a pale yellow, crystalline substance, $C_{14}H_{12}O_3$ (m. p. 133°). Derivatives of the latter have been obtained, and its general behaviour has been studied. It yields a characteristic dibromide, $C_{14}H_{12}O_3Br_2$ (m. p. 125°), in which, on treatment with water, one of the bromine atoms is replaced by a hydroxyl group, giving a compound, $C_{14}H_{13}O_4Br$ (m. p. 168—169°). A series of resins has also been separated, as well as a further crystalline compound (m. p. 112—114°).

The pharmacological action of the various constituents of the wood is at present under investigation by Prof. Cash, of Aberdeen University.

129. "Optically active derivatives of *l*-methoxy- and *d*-dimethoxy-succinic acids." (Preliminary note.) By Charles Robert Young.

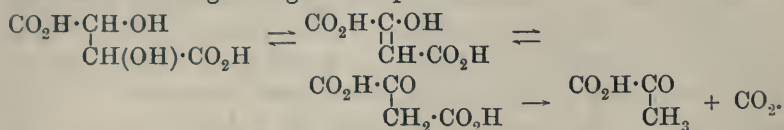
In continuation of previous work (Purdie and Young, *Trans.*, 1910, **97**, 1524), *d*-dimethoxysuccinilide and *d*-dimethoxysuccinilic acid have been prepared by the action of aniline on *d*-dimethoxysuccinic acid and its anhydride respectively. The anilide crystallises from benzene in slender needles (m. p. 137—139°), and in dilute acetone solution has $\alpha_D + 259^\circ$. The anilic acid (m. p. 120—122°) separates from solution in acetone in small prisms; in the same solvent it has $\alpha_D + 134^\circ$. Attempts are now being made to prepare, from the anilic acid, the corresponding anil and isoanil. Other active derivatives of *l*-methoxy- and *d*-dimethoxy-succinic acids of these types are under investigation with the view of studying their optical behaviour.

130. "The mechanism of the racemisation of some hydroxy-acids by heat." By Dan Ivor James and Humphrey Owen Jones.

The process of racemisation of malic acid in aqueous solutions (concentration about 8 per cent.) at about 160° has been studied,

and it has been found that racemisation takes place through the intermediate formation of fumaric acid, a change which is reversible.

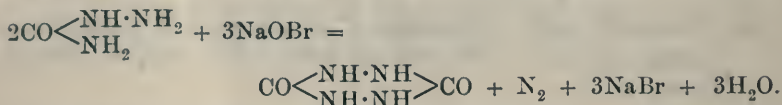
The corresponding change in the case of tartaric acid would produce hydroxyfumaric acid, as suggested by Nef; this acid itself or its isomeride, oxalacetic acid, would be expected to lose carbon dioxide and yield pyruvic acid. The formation of considerable quantities of pyruvic acid has been established, and it is probable that the following changes take place:



131. "The action of sodium hypobromite on carbamide derivatives."
By Frank William Linch.

The author has studied the regulated oxidation of certain carbamide derivatives by means of sodium hypobromite.

With semicarbazide the main product is *p*-urazine (yield, 80 per cent. of the theoretical) when the substances are allowed to react in the proportions indicated by the following equation:

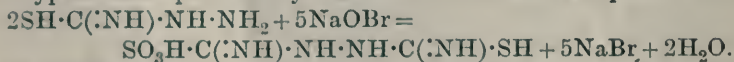


The reaction proceeds in stages, with the intermediate formation of hydrazodicarbonamide.

p-Urazine is very sensitive towards oxidising agents, the first product being '3:6-diketo-1:2:3:6-tetrahydro-1:2:4:5-tetrazine,



Thiosemicarbazide and hydrazodicarbonthioamide when oxidised by hypobromite produce hydrazodicarbonthioamidesulphonic acid:



No condensation product could be obtained from carbamide, but acetylcarbamide condenses as follows:



The author proposes to extend the investigation to other carbamide derivatives.

132. "Keto-enolic ethers and derivatives of dibenzoylmethane."

By Robert Duncombe Abell.

The object of this work was to prepare ethers of the type $\cdot\text{C}(\text{OR})\cdot\text{CH}\cdot\text{CO}\cdot$ by the silver oxide method, which did not appear to have been applied to the keto-enolic forms of the 1:3-diketones.

Phenyl α -hydroxystyryl ketone, $\text{OH}\cdot\text{CPh}\cdot\text{CH}\cdot\text{COPh}$, reacting with methyl iodide gave $\alpha\alpha$ -dibenzoylthane, $\text{CHBz}_2\cdot\text{CH}_3$; and with ethyl iodide gave $\alpha\alpha$ -dibenzoylpropane, $\text{CHBz}_2\cdot\text{CH}_2\cdot\text{CH}_3$, and a small quantity of phenyl α -ethoxystyryl ketone, $\text{OEt}\cdot\text{CPh}\cdot\text{CH}\cdot\text{COPh}$.

The methyl and ethyl esters of phenyl α -hydroxystyryl ketone were obtained in good yield from phenyl α -bromostyryl ketone by the action of sodium methoxide and ethoxide respectively.

Further, the sodium derivative of phenyl α -hydroxystyryl ketone reacts, under suitable conditions, with:

- (1) Methyl iodide to give $\alpha\alpha$ -dibenzoylthane.
- (2) Ethyl iodide to form $\alpha\alpha$ -dibenzoylpropane (compare Miss Smedley, *Trans.*, 1910, **97**, 1492).
- (3) Ethyl iodoacetate to produce *ethyl β -dibenzoylpropionate*, $\text{CHBz}_2\cdot\text{CH}_2\cdot\text{CO}_2\text{Et}$.
- (4) Iodine to give *s-tetrabenzoylthane*, $\text{CHBz}_2\cdot\text{CHBz}_2$, and *dibenzoyliodomethane*, CHBz_2I .
- (5) Benzyl iodide to form $\alpha\alpha$ -dibenzoyl- β -phenylethane,
 $\text{CHBz}_2\cdot\text{CH}_2\text{Ph}$.

(6) Benzoyl chloride to give the α - or diketo-enolic form of tribenzoylmethane, $\text{CBz}_2\cdot\text{CPh}\cdot\text{OH}$, and not the triketo-form (compare Claisen, *Annalen*, 1896, **291**, 95; Baeyer and Perkin, *Ber.*, 1883, **16**, 2135; Perkin, *Trans.*, 1885, **47**, 253).

Dibenzoyliodomethane and $\alpha\alpha$ -dibenzoyl- β -phenylethane show feeble enolic properties.

133. "Derivatives of phenyl styryl ketone. Part I. The tautomeric forms of dibenzoylmethane." By Robert Duncombe Abell.

This revision of Wislicenus's work (*Annalen*, 1899, **308**, 219), undertaken after identifying phenyl α -ethoxystyryl ketone with "dibenzoylmethane," was continued even after the appearance of Ruhemann and Watson's paper (*Trans.*, 1904, **85**, 456) as several new results had already been obtained.

Phenyl styryl ketone combines with bromine to form two isomeric dibromides, $\text{CHPhBr}\cdot\text{CHBr}\cdot\text{COPh}$, the one melting at 158° (Claisen and Claparède, *Ber.*, 1881, **14**, 2464; Wislicenus, *loc. cit.*), the other in very small yield melting at 122° (Miss Smedley, *Proc.*,

1909, **25**, 259, gives 113° , and Pond, York, and Moore, *Amer. Chem. J.*, 1901, **23**, 789, 108—109°).

The dibromide, melting at 122° , can be obtained in 90 per cent. yield by the union of hydrogen bromide with phenyl α -bromostyryl ketone, $\text{CBrPh}\cdot\text{CH}\cdot\text{COPh}$, in carbon disulphide solution.

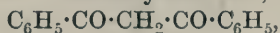
Phenyl α -bromostyryl ketone was prepared from the dibromide melting at 158° by the action of excess of potassium acetate in alcoholic solution (compare Wislicenus, *loc. cit.*).

According to Wislicenus, equimolecular quantities of phenyl α -bromostyryl ketone and sodium hydroxide in alcoholic solution when heated for half an hour gave a trace of phenyl α -hydroxystyryl ketone and "dibenzoylmethane," now known to be phenyl α -ethoxystyryl ketone.

The author finds that under these conditions phenyl styryl ketone is also formed.

If the same quantities of the reacting substances are heated only until the alkaline reaction disappears, phenyl α -hydroxystyryl ketone is not formed.

Wislicenus's "dibenzoylmethane" is phenyl α -ethoxystyryl ketone. The "dibenzoylmethane" of Baeyer and Perkin (*Ber.*, 1883, **16**, 2134) and of Claisen (*Ber.*, 1887, **20**, 655) is phenyl α -hydroxystyryl ketone. Dibenzoylmethane,



is still unknown.

134. "The interaction between di-iodoacetylene and organic sodio-derivatives." By Hugh Vernon Thompson.

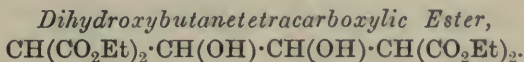
Di-iodoacetylene, although a very unstable substance, resembles the metallic derivatives of acetylene in that it exhibits but little tendency to react with the ordinary organic reagents; it therefore appeared of interest to examine its behaviour towards such highly reactive compounds as sodiomalonic and sodioacetoacetic esters.

Preparation of Di-iodoacetylene.

The method for preparing di-iodoacetylene given by Dehn (*J. Amer. Chem. Soc.*, 1911, **33**, 1598) only yields satisfactory results if certain precautions not mentioned by that author are taken. It is desirable to, purify the acetylene obtained by the action of water on commercial calcium carbide, by passing it through an aqueous solution of ammonium persulphate. The sodium hypochlorite solution, which is dropped into the solution of potassium iodide during the passage of the acetylene gas, should

be prepared by passing chlorine into a 10 per cent. solution of sodium hydroxide, and care must be taken that no excess of chlorine is ultimately present; if more concentrated sodium hypochlorite solutions are used, or if they contain free chlorine, the formation of di-iodoacetylene is considerably or completely inhibited. The preparation of the di-iodoacetylene should be carried out as rapidly as possible, and the precipitated substance collected immediately, washed, dried on porous earthenware, and dissolved in light petroleum; if left in contact with the mother liquor the di-iodoacetylene redissolves in part, leaving an unstable material, which explodes with violence when separated and left in contact with the air.

When the precautions indicated above are taken, the yield of crude di-iodoacetylene represents 80 to 90 per cent. of that theoretically obtainable from the amount of potassium iodide used; after purification by crystallisation from light petroleum, the yield is found to be smaller, because of the presence of a material insoluble in that solvent.



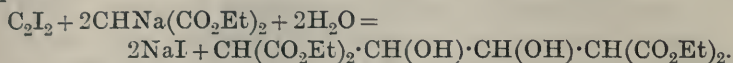
One molecular proportion of di-iodoacetylene is boiled with four molecular proportions of monosodiummalonic ester in alcoholic solution for several hours on the water-bath; the reaction is performed in the dark in order to prevent decomposition of the di-iodoacetylene by light. The alcohol is then distilled off, and the residue, after addition of water, extracted with ether; the ethereal extract on evaporation yields a viscous, reddish-brown residue, which contains no halogen, and which could not be caused to crystallise. This residue is distilled under ordinary pressure, and then undergoes considerable decomposition; the distillate, however, is a colourless oil, which slowly becomes partly crystalline. The crystalline material after separation and recrystallisation from ether is obtained in small, compact, colourless crystals, which melt at 72° :

0.2062 gave 0.1250 H_2O and 0.3835 CO_2 . $\text{C}=50.72$; $\text{H}=6.79$.

$\text{C}_{16}\text{H}_{26}\text{O}_{10}$ requires $\text{C}=50.77$; $\text{H}=6.93$ per cent.

1.9917 Grams dissolved in 26.45 grams of glacial acetic acid depressed the freezing point of the solvent by 0.81° . The molecular weight indicated is thus 363. 1.6347 Grams in 25.68 grams of the same solvent similarly depressed the freezing point by 0.64° , indicating a molecular weight of 390. The mean of the two determinations, namely, 376, agrees well with that corresponding with the molecular composition stated, namely, 378.

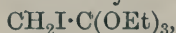
There seems little doubt that the substance is the dihydroxybutanetetracarboxylic ester which Polonowsky obtained (*Annalen*, 1888, **246**, 3) as a yellow syrup by the action of glyoxal and malonic ester in presence of zinc chloride. The formation of this product by the reaction now described may be represented by the equation:



On preserving the oily residue from which the above-described crystalline product had been separated, it gradually crystallised, and the crystalline compound thus obtained, after recrystallisation from ether, yielded colourless crystals melting at 47—48°. The quantity of material obtained was too small for further examination, but it is probable that the two crystalline substances melting at 72° and at 47—48° are the *cis*- and *trans*-modifications of dihydroxybutanetetracarboxylic ester.

Di-iodoacetylene reacts with sodioacetoacetic ester in alcoholic solution, and after evaporation of the alcohol, treatment of the residue with water, extraction of the aqueous solution with benzene, and evaporation of the benzene, an oily residue was obtained which was obviously a mixture; it could not be caused to crystallise, and decomposed when distilled under diminished pressure.

The attempt to cause di-iodoacetylene to condense with sodium ethoxide under various conditions led in each case to the isolation of a small yield of a dark-coloured, pungent-smelling liquid corresponding in properties with the ethyl iodo-orthoacetate,



prepared by Nef (*Annalen*, 1897, **298**, 350) in the same way.

This investigation, commenced at the suggestion of Prof. Pope, will be continued.

135. "The rotatory powers of the *d*- and *l*-methylethylphenacylthetine salts." Clara Millicent Taylor.

Externally compensated methylethylphenacylthetine bromide has been prepared in quantity, and resolved into its optically active components by the aid of the corresponding salts formed with *d*- α -bromocamphor- π -sulphonic acid. An extensive series of determinations of the rotation constants for the mercury green, mercury yellow, and sodium yellow lines has been made of the salts of *d*- and *l*-methylethylphenacylthetine with the latter acid, picric acid, and styphnic acid in various solvents.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

International Institute of Agriculture. Bulletin of the Bureau of Agricultural Intelligence and of Plant-diseases. 2nd year, No. 7, etc. Rome 1911+. (*Reference.*) From the Board of Agriculture.

Tibbles, William. Foods: their origin, composition and manufacture. London 1912. pp. viii+950. 18/- net. (*Recd.* 4/5/12.)

From the Publishers: Messrs. Baillière, Tindall and Cox.

II. *By Purchase.*

Allen, Alfred Henry. Commercial organic analysis. Vol. VI. 4th edition. Edited by **W. A. Davis** and **Samuel S. Sadtler**. London 1912. pp. ix+726. 21/- net. (*Reference.*)

Fürth, Otto von. Probleme der physiologischen und pathologischen Chemie. I Band. Gewebsschemie. Leipzig 1912. pp. xv+634. M. 16.—. (*Recd.* 9/5/12.)

Stahl, George Ernest. Philosophical principles of universal chemistry: or, the foundation of a scientific manner of inquiring into and preparing the natural and artificial bodies for the uses of life: Both in the way of experiment, and the larger way of business. Designed as a general introduction to the knowledge and practice of artificial philosophy: or, genuine chemistry in all its branches. Drawn from the *Collegium Jenense* of Dr. George Ernest Stahl by **Peter Shaw**. London 1730. pp. xxviii+424+[xxiv]. (*Reference.*)

Täuber, Ernst, and Norman, Ragnar. Die Derivate des Naphtalins. Berlin 1896. pp. viii+219. (*Recd.* 13/5/12.)

Thompson, M. de Kay. Applied electrochemistry. New York 1911. pp. xii+329. 9/- net. (*Recd.* 9/5/12.)

ERRATUM.

PROCEEDINGS, 1912.

Page 126, line 2 from below, in formula, for
$$\begin{array}{c} \text{"CH}\cdot\text{CH"} \\ | \quad | \\ \text{N} \text{---} \text{CH}_2 \end{array}$$
 read
$$\begin{array}{c} \text{"CH}\cdot\text{CH"} \\ | \quad | \\ \text{N} \text{---} \text{O} \end{array}$$
.

CANNIZZARO MEMORIAL LECTURE.

An Extra Meeting will be held on Wednesday, June 26th, at 8.30 p.m., when the Cannizzaro Memorial Lecture will be delivered by Sir William Tilden, F.R.S.

The next Ordinary Scientific Meeting will be held on Thursday, June 6th, at 8.30 p.m., when the following papers will be communicated:

"The absorption spectra of various derivatives of naphthalene in solution and as vapours." By J. E. Purvis.

"The velocity of the hydrogen ion, and a general dissociation formula for acids." By J. Kendall.

"Chloroamino-derivatives of benzylidene-diamides." By F. D. Chattaway and A. E. Swinton.

"The refractivity of sulphur in various aliphatic compounds." By T. S. Price and D. F. Twiss.

"The conditions of isodynamic change in the aliphatic ketones. Part I. The auto-catalytic reaction between acetone and iodine." By H. M. Dawson and F. Powis.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 28.

No. 403.

Thursday, June 6th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society in the death of M. Lecoq de Boisbaudran (elected an Honorary and Foreign Member in 1888) on May 28th.

Messrs. G. F. Wesley Martin, R. Robinson, and C. R. Wilkins were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

James Harry Dyson, North Lea, St. Ives Road, Skircoat Green, Halifax.

Sydney Charles Gadd, 31, St. David's Hill, Exeter.

Shigeru Komatsu, College of Science and Engineering, Kyoto Imperial University, Kyoto, Japan.

Ramni Paniker, M.A., M.Sc., c/o Messrs. Röhm & Haas, 4, Quai St. Clair, Lyons, France.

Hui Chun Tsao, B.Sc., I-Hing, Kiang-Su, China.

Of the following papers, those marked * were read:

*136. "The vapour density of ammonium nitrite."

By Prafulla Chandra Rây, Nilratan Dhar, and Tincowry De.

The vapour density of ammonium nitrite as determined by Hofmann's method at a temperature of 66° to 78° conforms to the normal value.

***137. "Pyrogenic decompositions. Part I. Benzene."**

By Clarence Smith and William Lewcock.

References to the literature show that a substance, produced by the pyrogenic decomposition of an organic compound, is obtained usually in very poor yield; for example, the best yield of diphenyl obtained by the pyrogenic decomposition of benzene is 30 per cent., recorded by Schultz (*Annalen*, 1874, **174**, 201). In the course of some experiments by one of the authors on the formation of isoprene by the pyrogenic decomposition of American turpentine, the prime importance of temperature and of duration of heating on the course of the decomposition has been made very manifest.

The experience thus gained has been applied in the pyrogenic decomposition of benzene, with the result that a continuously-working apparatus has been constructed, whereby benzene is converted into diphenyl to the extent of 70 per cent. of the theoretical yield; solid by-products are formed only in traces.

***138. "The absorption spectra of certain aromatic nitroamines and**

nitroamides." By Gilbert T. Morgan, Edgar Jobling, and Raymond T. F. Barnett.

The authors have continued the spectroscopic examination of certain of the polynitrated aromatic amines (compare *Trans.*, 1911, **99**, 1945), and particularly of the dinitro-derivatives of this series.

The absorption curve of 2:6-dinitro-*p*-toluidine was found to be quite comparable with that of the tertiary amine, 2:6-dinitro-dimethyl-*p*-toluidine, both bases showing very considerable suppression of the absorption band.

On comparing the absorption spectra of 3:5-dinitro-*p*-toluidine, 3:5-dinitromethyl-*p*-toluidine, and 3:5-dinitrodimethyl-*p*-toluidine, it was found that only the tertiary amine showed this suppression, both the primary and secondary bases exhibiting a well-marked absorption band, that of the former base being the more persistent.

5 : 6 - Dinitro-3-amino-*o*-xylene and 3:5-dinitro-6-amino-*o*-xylene also show this suppression of the band characteristic of the majority of aromatic nitroamines, whereas 3:5-dinitro-4-amino-*o*-xylene, 3 : 4 - dinitro-5-amino-*o*-xylene, and 4 : 5 - dinitro-3-amino-*o*-xylene exhibit selective absorption of the normal type.

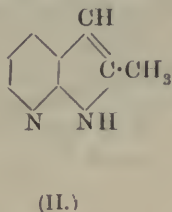
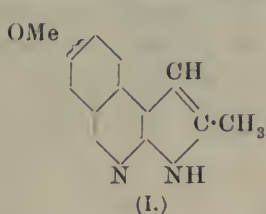
Picramide shows two well-defined absorption bands. Toluene-*p*-sulphonyl-1-nitro- β -naphthylamine (yellow) and its *N*-methyl derivative (colourless) and toluene-*p*-sulphonyl-1:6-dinitro- β -naphthylamine (colourless) do not exhibit absorption bands, either in the visible or ultra-violet regions of the spectrum.

The aromatic nitroamides exhibit absorption spectra of the same general type without absorption bands, whether the acyl groups are inorganic (NO , NO_2) or organic ($\text{CH}_3\cdot\text{CO}$, $\text{SO}_2\cdot\text{C}_7\text{H}_7$, etc.).

***139. "The constitution of harmine." (Preliminary note.)**

By William Henry Perkin, jun., and Robert Robinson.

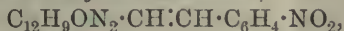
The authors have commenced a series of experiments on the alkaloids of *peganum harmala*, and are now in a position to suggest an expression (I) which readily affords an explanation of the reactions of harmine, and cannot be very far from the true representation of the constitution of this substance:



The complete argument on which this formula is based cannot be given here, but, in addition to the facts which have already been observed by other workers, among whom O. Fischer is the most prominent, the following new observations have greatly contributed to the solution of the problem. Harmine contains an NH -group and a methyl group, which has the power of condensing with aldehydes, etc., characteristic of the methyl group in quinaldine.

Benzylideneharmine, $\text{C}_{12}\text{H}_9\text{ON}_2\cdot\text{CH}:\text{CHPh}$, is obtained by boiling harmine with excess of benzaldehyde, and is purified by conversion into the sparingly soluble, bright yellow, crystalline hydrochloride.

The base separates from ethyl alcohol in pale yellow prisms melting at $191\text{--}192^\circ$, and its solutions have a most intense violet fluorescence. *p*-Nitrobenzylideneharmine,



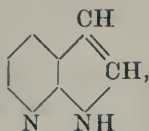
prepared by heating together harmine and *p*-nitrobenzaldehyde, separates from alcohol in red needles and melts at 266° .

C-Benzylharmine, $\text{C}_{12}\text{H}_9\text{ON}_2\cdot\text{CH}_2\cdot\text{CH}_2\text{Ph}$, obtained by the reduction of benzylideneharmine with zinc dust and acetic acid, crystallises from methyl alcohol in rectangular prisms melting at 138° .

The sparingly soluble *hydrochloride* separates from water in colourless needles which, in dilute solution, exhibit a blue fluorescence.

Nor-harminecarboxylic acid, $C_{12}H_9ON_2 \cdot CO_2H$, obtained by the oxidation of benzylideneharmine with potassium permanganate in acid solution, crystallises from acetic acid in the form of the acetate in yellow prisms. This substance loses acetic acid on heating at 100° , or better by treatment with hot water, and furnishes the free acid as a pale yellow, crystalline powder, which is almost insoluble and could not be recrystallised. Its salts, both with acids and alkalis, are crystalline and sparingly soluble in water. With ferrous sulphate it develops a brownish-red coloration, which again clearly indicates that the methyl group in harmine is in the α -position with respect to one of the nitrogen atoms.

The formula of *apoharmine* (II) deduced from that suggested for harmine (I) is that of 2-methylindole, in which one of the methine groups of the benzene ring is displaced by a nitrogen atom. Such substances have not yet been prepared (see, however, the following note), and the properties of such a fused pyridine-pyrrole nucleus are unknown. There can, however, be little doubt that the pyridine ring would greatly modify that of the pyrrole ring, and the structure,



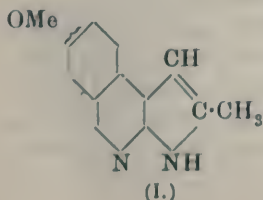
may be regarded as an independent nucleus probably presenting closer analogy to benzimidazole than to either quinoline or indole.

A number of experiments are in progress, having for their object the synthesis of substances containing the pyridine and pyrrole rings fused in various positions.

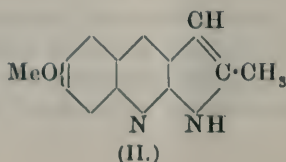
***140. "The synthesis of *isoharman*." (Preliminary note.)**

By William Henry Perkin, jun., and Robert Robinson.

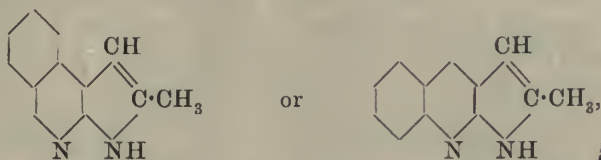
An important stage in the argument developed in connexion with the constitution of harmine consists in deciding between the structures:



and

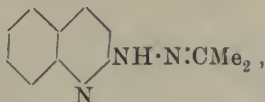


O. Fischer (*Chem. Centr.*, 1901, 1, 957) eliminated the methoxy-group from harmine, and obtained a base, harman, which, on the basis of the above formulæ for harmine, would have the constitution:



and in order to obtain evidence on this point the authors have synthesised the latter base. This derivative of quinoline, although very similar to harman, does not appear to be identical with it, and the *isoquinoline* structure (I) is therefore ascribed to harmine, a view which is supported by other considerations.

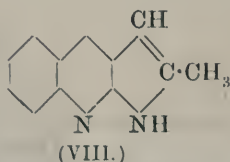
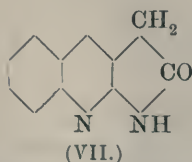
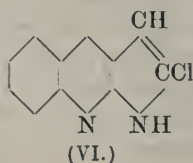
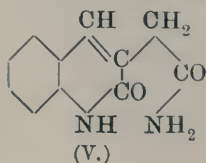
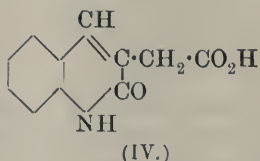
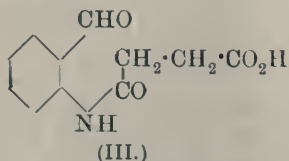
In the first experiments on the synthesis of *isoharman*, an attempt was made to apply the Fischer indole synthesis to *acetone- α -quinolylhydrazone*,



This substance, which is readily obtained from α -quinolylhydrazine and acetone, crystallises from light petroleum in pale yellow prisms melting at 102° , but indole formation could not be achieved either by heating with hydrochloric acid or zinc chloride, since hydrolysis occurred in both cases. The following indirect method of synthesis was, however, successful.

o-Aldehydosuccinanic acid (III) was prepared by the condensation of *o*-aminobenzaldehyde and succinic anhydride in boiling xylene solution, and crystallises from methyl ethyl ketone in prismatic needles melting at 115° . On boiling in aqueous solution with a little more sodium hydroxide than is necessary to neutralise it, this acid undergoes internal condensation with the formation of *carbostyryl- β -acetic acid* (IV), which crystallises from acetic acid in colourless needles and melts at 270° . The *methyl* ester of this acid melts at 176° , and is converted by aqueous ammonia at 100° into the *amide* (V), which crystallises from dilute acetic acid in microscopic needles and melts at 258° . When this amide is boiled with phosphoryl chloride, a remarkable reaction takes place, and *chloronorisoharman* (VI) is produced. This substance crystallises from dilute acetic acid in pale yellow leaflets melting at 127° , and is converted by boiling, in acetic acid solution, with potassium acetate into a neutral substance, $C_{11}H_8ON_2$, which is very sparingly soluble in organic solvents, melts at 235° , and is evidently either

hydroxynorisocharman, the lactim, or the corresponding lactam of α -aminoquinoline- β -acetic acid (VII). The solution of chloronor*iso*-harman in boiling amyl ether reacts with a solution of magnesium methyl iodide in the same solvent with the formation of a base which, although its investigation is not yet complete, is regarded as *isocharman* (VIII):



isoHarman crystallises from methyl alcohol in leaflets, melts at about 213° , and, when heated in small quantities, sublimes with little decomposition. Its solution in sulphuric acid is colourless, and exhibits a bluish-violet fluorescence. The salts are crystalline and sparingly soluble in water; the *hydrochloride* crystallises in slender, yellow needles, and the *mercurichloride* in long needles.

The *picrate* is sparingly soluble in all solvents, but may be crystallised from methyl ethyl ketone, from which it separates in yellowish-green needles, which darken above 240° and melt and decompose at about 253° . The properties of *isocharman* are therefore strikingly similar to those of *harman*, which also sublimes, is readily soluble in alcohol, and dissolves in sulphuric acid to a bluish-violet, fluorescent solution. *Harman* melts, however, at 230° , and appears to be more soluble in hot water than *isocharman*. Moreover, aqueous solutions of the salts of *harman* exhibit a blue fluorescence, whereas the corresponding salts of *isocharman* do not appear to fluoresce.

- *141. "Blue adsorption compounds of iodine. Part I. Starch, saponarin and cholalic acid." By George Barger and Ellen Field.

The crystalline iodide of cholalic acid is in the main an additive compound of one atom of iodine to one molecule of the acid. By acidification of a solution of sodium cholalate containing iodine, the blue substance can be made to separate in the amorphous condition, and then it adsorbs much more iodine. Adsorption is the most important factor in the formation of the blue iodides of starch and of saponarin, and is brought about by the cation of electrolytes, the presence of which is a necessary condition for the formation of these iodides.

In all three cases the blue compounds behave like electronegative lyophobic colloids; their precipitation from solution by electrolytes depends chiefly on the valency of the cation, and follows Schulze's law; they are also precipitated by electropositive dyes. With night-blue there is a zone of optimal concentration. The lyophobic properties are only slightly marked in the case of starch iodide.

The distribution of iodine between the solution and the amorphous compounds is in all cases given by an exponential formula, which in the case of saponarin and of cholalic acid only applies over a comparatively short range of concentrations. The blue hydrosol of saponarin becomes colourless more or less abruptly at a dilution of 1:7000, corresponding with the true solubility, when the whole of the substance becomes molecular-disperse.

DISCUSSION.

Prof. MORGAN referred to the interesting point mentioned by the authors that salts of the more electropositive metals favoured the production of adsorption iodine complexes, and suggested a comparison of the behaviour of caesium with that of barium and lanthanum, since these three elements are the most electropositive members of their respective families.

142. "The absorption spectra of various derivatives of naphthalene in solution and as vapours." By John Edward Purvis.

The absorption spectra of various α - and β -derivatives of naphthalene show that (1) the nature and type of the solution bands is controlled by the nature and type of the substituting atom or group of atoms, and (2) the vapours of these substances exhibit

bands which are comparable with the solution bands. These results were discussed with regard to the intrinsic vibratory energy of the molecules and their valencies.

143. "The velocity of the hydrogen ion and a general dissociation formula for acids." By James Kendall.

The following modification of the conductivity method has been used to determine the velocity of the hydrogen ion. The dissociation constants for weak acids at high dilutions are found to be more or less satisfactory, according to the value employed for the velocity of the hydrogen ion. With acids of a certain limited range of strength (100*k* between 0.1 and 1.0), one particular value alone will give a satisfactory constant. Experiments have been carried out with several acids and with different samples of water, and the value finally deduced is 347.2 at 25°, with a maximum divergence of ± 0.4 .

In more concentrated solutions the above acids diverge considerably from the simple dilution law. Their dissociation, however, can be exactly expressed by the formula:

$$m^2/(1-m)v = k + c(1-m)/m.$$

This formula is intermediate between those of Ostwald and van't Hoff, and has been extended to all types of acids. In all cases the agreement between the calculated and observed values is within the limits of experimental error. The above formula is therefore found to be universally applicable for acids.

144. "*N*-Chloro-derivatives of benzylidene-diamides." By Frederick Daniel Chattaway and Alan Edulf Swinton.

The benzylidene-diamides which are produced when benzaldehyde is heated with amides, although very easily hydrolysed, yield *N*-chloro-derivatives with hypochlorous acid.

From benzylidenediacetamide the dichloro-compound has been prepared, but from benzylidenedibenzamide only the mono-chloro-derivative has been obtained, this, on account of its sparing solubility, being easily isolated. These compounds show the usual general characteristics of chloroamino-derivatives. They are easily hydrolysed, even on long exposure at the ordinary temperature to moist air, benzaldehyde and chloro-acetamide or -benzamide being formed.

They react vigorously with warm concentrated potassium hydroxide solution, benzaldehyde, potassium carbonate, and a

primary amine being produced. Probably hydrolysis first takes place, the chloro-amide subsequently undergoing the Hofmann transformation under the influence of the alkali hydroxide.

145. "The refractivity of sulphur in various aliphatic compounds."

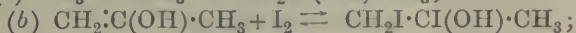
By Thomas Slater Price and Douglas Frank Twiss.

The densities and refractive indices at 16° and 25° of the various dithio-esters previously prepared by the authors (*Trans.*, 1908, **93**, 1645; 1909, **95**, 1050) have been determined, and the corresponding molecular refractivities calculated. From the results, the atomic refractivity of sulphur has been deduced, and the values so obtained have been compared with those deduced from sulphur compounds prepared by other investigators, especial reference being made to the optical effect of auxiliary valencies (compare Eisenlohr, *Ber.*, 1911, **44**, 3188).

146. "The conditions of isodynamic change in the aliphatic ketones.

Part I. The autocatalytic reaction between acetone and iodine." By Harry Medforth Dawson and Frank Powis.

If a small quantity of iodine is added to a neutral aqueous solution of acetone, the velocity with which the iodine disappears increases rapidly as the reaction proceeds, in consequence of the catalysing effect of the hydriodic acid which is formed as one of the products of the interaction. The change takes place in three stages: (a) $\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_3 \rightleftharpoons \text{CH}_2 \cdot \text{C}(\text{OH}) \cdot \text{CH}_3$;

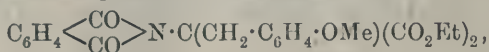


and (c) $\text{CH}_2\text{I} \cdot \text{CI}(\text{OH}) \cdot \text{CH}_3 \rightleftharpoons \text{CH}_2\text{I} \cdot \text{CO} \cdot \text{CH}_3 + \text{HI}$, and the halogen acid which is set free in the third stage accelerates the primary isodynamic change in proportion to the quantity present. The observed progress of the change is in agreement with the assumption that the second and third stages in the reaction are of relatively high speed.

The initial velocity of the reaction in "neutral" solution appears to be much greater than can be accounted for on the basis of the original acidity, and experiments, in which small quantities of halogen acid, alkali, and sodium acetate were added to the solution at the start, seem to show that the isodynamic change is accelerated by other than acid catalysts. Although bases probably accelerate the reaction, the observed facts cannot be interpreted on the assumption that the change is conditioned by the presence of acids or bases, and it is suggested that water, independently of its ionising properties, plays the part of an accelerator.

147. "Tyrosine and its derivatives containing substituents in the benzene ring." (Preliminary note.) By Henry Stephen and Charles Weizmann.

Ethyl phthalimino-p-methoxybenzylmalonate,



was prepared by heating molecular quantities of *p*-methoxybenzyl bromide and the potassium compound of ethyl phthaliminomalonate with xylene in an oil-bath at 145° for six hours. When purified by crystallisation from ethyl alcohol it melts at 83°.

Tyrosine was obtained by hydrolysis of the above compound (a) with concentrated aqueous sodium hydroxide, and subsequent decomposition with concentrated hydrochloric acid according to Sørensen and Andersen's method (*Zeitsch. physiol. Chem.*, 1908, **56**, 266); (b) with concentrated hydrochloric acid in a sealed tube at 175° for two hours.

Ethyl phthaliminopiperonylmalonate,



was obtained similarly by condensing piperonyl bromide and ethyl phthaliminomalonate. After recrystallisation from methyl alcohol it melts at 89°.

148. "Configuration of the stereoisomeric dibromosuccinic acids."

By Alex. McKenzie.

A detailed account of work of which a preliminary note has already been published (*Proc.*, 1911, **27**, 150).

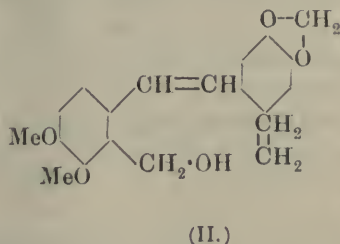
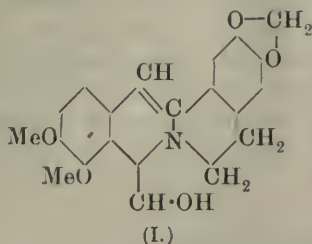
l-Dibromosuccinic acid melts at 157—158°, and has $[\alpha]_D^{13} -148^\circ$ in ethyl acetate solution.

The action of water on the *l*-acid and its barium and silver salts was examined.

149. "The exhaustive alkylation of tetrahydroberberine." By James Wallace McDavid, William Henry Perkin, jun., and Robert Robinson.

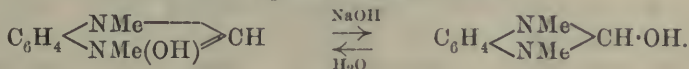
The authors have combined tetrahydroberberine (I) successively with benzyl chloride and with methyl iodide, and, by decomposing the final product with alcoholic potassium hydroxide, have obtained

a substance (II) free from nitrogen, which they propose to name *berberilene*:

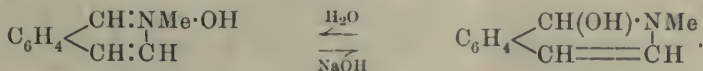


150. "The spectroscopic investigation of the carbinol-ammonium base isomerism. Benziminazole and *isoquinoline* derivatives."
By Charles Kenneth Tinkler.

The transformation of dimethylbenziminazolium hydroxide into the corresponding carbinol, dimethylbenziminazolol, and the reverse change of carbinol into ammonium base, has been followed by ultra-violet absorption spectra measurements:



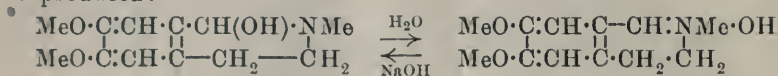
In the case of the *isoquinoline* derivatives, evidence was obtained of the conversion of 2-methyl*isoquinolinium* hydroxide into 1-hydroxy-2-methyl-1:2-dihydro*isoquinoline* by the action of sodium hydroxide and of the re-conversion of the carbinol into the ammonium base by the action of water, as recently suggested by Decker (*J. pr. Chem.*, 1911, [ii], **84**, 425):



By this method of investigation it appears also that the substituted *isoquinoline*, tarconine methiodide yields a ψ -base.

The *isoquinoline* base obtained by Pyman by the oxidation of laudanosine (*Trans.*, 1909, **95**, 1266) gives spectra in ethereal, chloroform, and sodium hydroxide solution, which are almost identical with those of the hydro-derivative and ψ -cyanide of the base, whereas in aqueous solution the spectra of the base are in very close agreement with those of the quaternary salts of the base. From the spectroscopic results obtained with this substance it would appear that the base is more correctly represented as the closed chain carbinol 1-hydroxy-6:7-dimethoxy-2-methyltetrahydro-*isoquinoline* than as the open-chain aldehyde 4:5-dimethoxy-2 β -methylaminoethylbenzaldehyde, as suggested by Pyman. The base

resembles in all respects cotarnine and hydrastinine, which have previously been investigated by this method (Dobbie, Lauder, and Tinkler, *Trans.*, 1903, **83**, 598; 1904, **85**, 1005). As in these cases it appears that by the action of the water the true ammonium base is produced:



151. "Some derivatives of oxazole."

By Joseph Lister and Robert Robinson.

A number of aryl-oxazoles have been prepared by the dehydration of acylated amino-ketones in order that their fluorescence and ultra-violet absorption spectra might be investigated.

152. "Electrolytic reduction. Part VII. The catalytic action of copper." By Herbert Drake Law.

It has been discovered that finely divided copper exerts a powerful catalytic action on the course of reduction of the $\alpha\beta$ -unsaturated ketones and aldehydes of the aliphatic and alicyclic series. These compounds are reduced more rapidly on copper than lead, but at the same time the latter metal combines with the partly reduced product. Copper, on the other hand, remains unattacked. The nature of the reduction reaction varies with different compounds. The attack may take place either at the carbonyl group or the unsaturated linking, or at both simultaneously. Hydrocarbons, saturated and unsaturated alcohols, saturated carbonyl compounds, and complex double molecules are formed either singly or in mixture.

153. "The two sulphides of β -naphthol."

By Cecil Reginald Crymble, Kenneth Ross and Samuel Smiles.

Henriques (*Ber.*, 1894, **27**, 2999) has shown that β -naphthol sulphide (m. p. 211°) may be converted into another sulphide of lower melting point (153°) by oxidation and subsequent reduction of the product; it has also been claimed that these sulphides are stereoisomeric. The authors have compared some reactions of these compounds, and the evidence bearing on the relationship between them was considered. The conclusion was drawn that the hypothesis of stereoisomerism is insufficient, and that the two sulphides differ in their atomic structure.

154. " α -Hydroxyhippuric acid and a new test for hippuric acid."

By Paul Haas.

α -Hydroxyhippuric acid is prepared by adding bromine to a gently warmed mixture of hippuric acid and red phosphorus suspended in carbon tetrachloride, and pouring the resulting mixture into water.

The test for hippuric acid depends on its conversion into α -hydroxyhippuric acid, and the subsequent hydrolysis of this substance to benzamide and glyoxylic acid, the latter being detected by the addition of a protein solution and concentrated sulphuric acid.

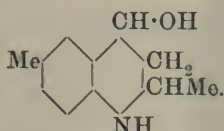
155. "The constitution of the aldol bases." By Muriel Gwendolen Edwards, Ralph Eddowes Garrod, and Humphrey Owen Jones.

The two "*aldol bases*," $C_{12}H_{17}ON$, prepared from *m*-4-xylidine and acetaldehyde, were studied by Jones and White (*Trans.*, 1910, 97, 633), and it was found that they were interconvertible by the action of acids, but not by the action of heat; both gave the same benzoyl compound, the same oxime, and the same condensation product with *m*-4-xylidine, but they gave different nitroso-derivatives.

In order to arrive at a definite conclusion as to the cause of this interesting case of isomerism, the study of these compounds has been extended, and the corresponding bases obtained from *p*-toluidine, ψ -cumidine, and 3-bromo-*p*-toluidine have been examined. The clue to the solution of the problem was found when it was established that the isomeric aldol bases from *p*-toluidine gave two different monobenzoyl compounds, and that the nitroso-derivatives of these bases could be benzoylated.

It was then found that by treatment with acetyl chloride in pyridine solution diacetyl derivatives could be prepared, and in a similar way two isomeric dibenzoyl derivatives were obtained from the xylidine aldol bases.

These observations can only be accounted for on the assumption that the isomeric aldol bases are the *cis*- and *trans*-stereoisomerides of hydroxytetrahydroquinoline derivatives, for example:

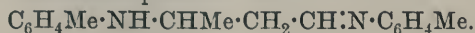


in the case of the *p*-toluidine compounds.

This view explains all the known facts, and also accounts for the non-formation of similar compounds from mesidine and 5-bromo-*m*-4-xylidine.

The hydroxytetrahydroquinoline ring must be capable of fission very easily on account of the formation of the oxime, the inter-conversion of the isomerides by acids, and the formation of the same condensation product with xyloidine in the case of the aldol bases derived from xyloidine.

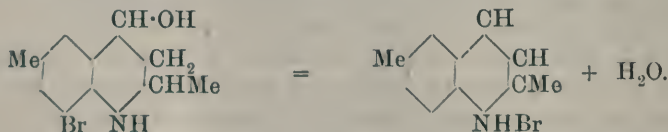
These condensation products, the double Schiff's bases, appear to precede the aldol bases in the interaction of acetaldehyde and amines, and as they give monobenzoyl and mononitroso-derivatives their structure is best represented as:



156. "Some quinoline and tetrahydroquinoline derivatives obtained from aldol bases." By Ralph Eddowes Garrod, Humphrey Owen Jones, and Percy Edwin Evans.

During the study of the constitution and properties of the "aldol bases" and their conversion under the influence of heat or of acids into quinoline and tetrahydroquinoline derivatives, the behaviour of the aldol bases derived from ψ -cumidine and 3-bromo-*p*-toluidine has been studied. The former are converted either by heat or by acids into a mixture of 2:5:6:8-tetramethylquinoline (m. p. 27—28°) and 2:5:6:8-tetramethyltetrahydroquinoline in equimolecular proportions.

When the aldol base of 3-bromo-*p*-toluidine is heated to 180—200° it changes quantitatively into the hydrobromide of 2:6-dimethylquinoline, according to the following scheme:



On boiling with acids, however, 8-bromo-2:6-dimethylquinoline (m. p. 96—97°) and 8-bromo-2:6-dimethyltetrahydroquinoline are produced, together with a small quantity of 2:6-dimethylquinoline and hydrogen bromide.

157. "The viscosity of ether-alcohol mixtures."

By Frank Baker.

The viscosities of mixtures in different proportions of the following ethers and alcohols have been observed—methyl, ethyl, and propyl alcohols; ethyl ether, anisole, and phenetole.

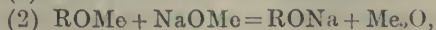
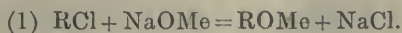
From the results obtained, it was concluded that dissociation of the alcohol and association to an ether-alcohol complex took place in these mixtures. The bearing of these results on the viscosity of mixtures in general was discussed, and the relation $\eta^n = a\eta_1^n + (1-a)\eta_2^n$ shown to be empirical.

158. "Morphotropic relationships between racemic compounds and their optically active components." By George Jerusalem.

The author has examined crystallographically a number of optically active and racemic compounds, and studied the relationship observable between the crystalline structure of racemic compounds and their optically active components in these and many other cases. In all the instances examined it is found that a close morphotropic relationship exists between these substances, and that the relationship is precisely of the kind foretold by the theory of Barlow and Pope concerning the connexion of crystalline form with chemical composition and constitution.

159. "The action of sodium methoxide on 2:3:4:5-tetrachloropyridine. Part I." By William James Sell.

As is well known, halogen derivatives of pyridine, when heated with sodium methoxide frequently give rise to hydroxy- instead of methoxy-compounds, but no satisfactory explanation of this reaction has hitherto been offered. The author finds that when 2:3:4:5-tetrachloropyridine is heated to 205° with sodium methoxide in a sealed tube, a mixture of gaseous products is produced, mainly composed of methyl ether and hydrogen. It is suggested that the methoxy-derivative of pyridine first formed reacts with the excess of sodium methoxide to produce methyl ether, thus:



and that the hydrogen is produced by the action of sodium hydroxide on the methyl alcohol present, with production of sodium formate and hydrogen.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Archbutt, Leonard, and **Deeley, R. Mountford.** Lubrication and lubricants. A treatise on the theory and practice of lubrication, and on the nature, properties, and testing of lubricants. 3rd edition. London 1912. pp. xxxvi + 599. ill. 25/- net. (*Recd.* 5/6/12.) From the Authors.

Lieben, Adolf. Collected papers, 1854—1910. 2 vols. (*Reference.*)
From the Author.

MacEwan, Peter. The art of dispensing : a treatise on the methods and processes involved in compounding medical prescriptions. With dictionaries of abbreviations, [etc.]. 9th edition. London 1912. pp. viii + 584. ill. 6/- (*Recd.* 18/5/12.) From the Author.

III. *Pamphlets.*

Diamare, V. Die Biologie des Eies, als eine chemisch-anatomische Koordination. (From the *Anat. Anzeiger*, 1911, 40.)

Emde, Hermann. Spaltung des Phenäthyl-trimethyl-ammoniums. (From the *Apoth. Zeit.*, 1912, 27.)

Filippi, Eduardo. Contegno farmacologico di alcuni preparati mercuriali insolubili. I. (From the *Arch. Farm. Sper.*, 1911, 12.)

— Di alcune combinazioni e preparazioni iodiche usate comunemente in terapia. (From the *Arch. Farm. Sper.*, 1911, 12.)

— Proprietà farmacologiche dell' Adalina (Bromodietilacetil-carbammide). (From the *Arch. Farm. Sper.*, 1911, 12.)

Luzzatto, R., and Satta, G. Intorno al comportamento nell' organismo animale dell' orto-jodanisolo. (From the *Arch. Farm. Sper.*, 1911, 11.)

Mameli, Efsio, and Patta, Aldo. Dell' acido para-iodiofenilarsinico e di alcuni suoi derivati. II. and III. (From the *Arch. Farm. Sper.*, 1911, 11 and 12.)

Miyake, K. Ueber die Nicht-Eiweiss-Stickstoff Bestandteile der Schösslinge von *Sasa paniculata*. (From the *J. Coll. Agric. Tohoku Imp. Univ.*, 1911, 4.)

Miyake, K., and Tadokoro, T. On the carbohydrates of the shoots of the *Sasa paniculata*. (From the *J. Coll. Agric. Tohoku Imp. Univ.*, 1911, 4.)

Oshima, K., and Tadokoro, T. On the carbohydrate group in Yam Mucin. (From the *J. Coll. Agric. Tohoku Imp. Univ.*, 1911, 4.)

CANNIZZARO MEMORIAL LECTURE.

An Extra Meeting will be held on Wednesday, June 26th, at 8.30 p.m., when the Cannizzaro Memorial Lecture will be delivered by Sir William Tilden, F.R.S.

The next Ordinary Scientific Meeting will be held on **Thursday, June 20th, 1912, at 8.30 p.m.**, when there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The formation of neon as a product of radioactive change." By Sir William Ramsay.

"The colour intensity of copper salts." By S. U. Pickering.

"Nitrites of the mercurialkyl- and mercurialkylaryl-ammonium series. Part II." By P. C. Rây, N. Dhar, and T. De.

"An analysis of the waters of the thermal springs of Bath." By I. Masson and Sir William Ramsay.

"Studies on certain aliphatic hydroxy-acids." By H. J. H. Fenton and W. A. R. Wilks.

"Formation of seven- and eight-membered rings from 2:2'-ditolyl." By J. Kenner.

"Studies of dynamic isomerism. Part XIII. Camphorcarboxylamide and camphorcarboxypiperidide. An illustration of Barlow and Pope's hypothesis." By W. H. Glover and T. M. Lowry.

"Studies of dynamic isomerism. Part XIV. Successive isomeric changes in camphorcarboxylamide and camphorcarboxypiperidide." By T. M. Lowry and W. H. Glover.

"Contributions to the chemistry of the terpenes. Part XIII. The preparation of pure bornylene." By G. G. Henderson and W. Caw.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on June 20th, 1912.

Allcock, Thomas,

The Rookery, Pye Bridge, Alfreton.

Analytical Chemist. Was seven years under Mr. C. H. Ridsdale, F.I.C., F.C.S., at the North Eastern Steelworks, Middlesbro', and I am now in charge of the Laboratory at the Alfreton Ironworks, Derbyshire.

C. H. Ridsdale.

R. B. Wight.

J. E. Stead.

H. Frankland.

N. D. Ridsdale.

Ernest W. Jackson.

Barnett, Raymond Theodore Fred,

19, Merton Street, Swindon, Wilts.

Student (National Scholar, Royal College of Science, S.W.). Associate of the Royal College of Science (Chemistry); B.Sc. London (Second Class Honours in Chemistry); Post-graduate work in Organic Chemistry at the Royal College of Science since October, 1911.

M. O. Forster.

G. T. Morgan.

James C. Philip.

Chapman Jones.

A. A. Eldridge.

Bews, Charles James Vinall,

52, Sir John's Road, Selly Park, Birmingham.

Assistant Master. Bachelor of Science (Honours Chemistry); Associate of Royal College of Science (Chemistry); Teacher of Chemistry (1906-1912).

M. O. Forster.

James C. Philip.

Chapman Jones.

G. T. Morgan.

Lionel M. Jones.

Birks, Cyril Douglas,

Cobnar Gardens, Woodsents, Sheffield.

Gas Representative and Chemist to Messrs. Hattersley & Davidson, Ltd., Sheffield. Four years Assistant Chemist to the Bradford

Corporation Gas Department; First Class Honoursman in Gas Engineering and Gas Supply (City and Guilds), also First Class Second Stage Practical Chemistry (Science and Art). Am desirous of keeping in touch with current chemical literature.

Harold G. Colman.

Walter M. Gardner.

Julius B. Cohen.

Barker North.

Wm. Cranfield.

G. W. Slatter.

Bowater, William Henry,
Charters Towers.

Senior Demonstrator in Chemistry, Assaying, and Metallurgy, School of Mines, Charters Towers. I became a Student at the above School in February, 1907. Have had ten years Practical Mining experience, having been Underground Manager of the Ruby P.C.G.M. Co. on this field. In September, 1909, I resigned the above to take up the position of Manager of the Venus Cyanide Works. I obtained the Diploma of Metallurgical Chemist and Assayer at this School in 1910. Resigned the management of the Venus Cyanide Works to take up the position of Junior Demonstrator in Chemistry and Assaying at this School in April, 1910. Was promoted to the position of Senior Demonstrator in Chemistry, Assaying, and Metallurgy in September, 1911, a position which I now hold.

George J. Saunders.

Basil Turner.

J. A. Schofield.

J. A. Hughes.

Charles Walker.

Brindle, Harry,

225A and 227A, Oxford Road, Manchester.

Principal of the Manchester College of Pharmacy. Pharmaceutical Chemist (successful at all the Pharmaceutical examinations at the first attempt). Fairchild Scholar, and prizewinner in several analytical competitions. Demonstrator at Manchester College of Pharmacy, 1910-1911, superintending practical work in the laboratories. Now co-principal.

Chas. Turner.

Robert Pettigrew.

Henry Garnett.

E. F. Harrison.

James Porter Shenton.

Campbell, Alfred Varlow,

Rothamsted Experimental Station, Harpenden.

Agricultural Chemist. Student in Chemical Department, Central Technical College, London, 1906-1909. Diploma of A.C.G.I. Carrying out research at Rothamsted Experimental Station, 1909-1911; Chemist to Ecological Committee; Tobacco Investigator

to the Development Commission. Published work : " Carbohydrates in the Mangold Leaf " (*J. Agric. Science*, 1912, Vol. IV, Part 3).

A. D. Hall.

E. J. Russell.

H. B. Hutchinson.

Henry E. Armstrong.

W. A. Davis.

N. H. J. Miller.

J. Vargas Eyre.

Campbell, Arthur Fred,

Westwood, Middleton, Manchester.

Research Chemist. Research Chemist, Messrs. Hardman & Holden, Ltd., Manufacturing Chemists. Three years Student in the Chemical Laboratories of the University of Manchester ; one year Research Student ; B.Sc. Honours in Chemistry ; M.Sc. Publications with Dr. J. F. Thorpe in the *Transactions*, 1910, 97, 118 and 248. Two years Research Chemist, Messrs. Burt, Boulton & Haywood, Ltd., Tar Distillers, etc.

Harold B. Dixon.

W. H. Perkin.

Ch. Weizmann.

E. C. Edgar.

A. Lapworth.

Norman Smith.

Alfred Holt.

Jocelyn Thorpe.

Chatterji, Bamacharan,

4, Cornwallis Square, Calcutta.

Assistant Professor of Chemistry, Scottish Churches College, 4, Cornwallis Square, Calcutta. B.A. (University of Allahabad) ; M.A. (University of Calcutta). Sometime Tikari Professor of Chemistry, B.N. College, Bankipur. Author of a Practical Chemistry for Intermediate Students.

J. Watt.

P. C. Rây.

B. C. Dutt.

Puñchānan Neogi.

Jyotibhushan Bhaduri.

Cheshire, Frank Lothian

Mines Department, Brisbane, Queensland, Australia.

A Staff Officer, Mines Department, Brisbane, Queensland. Graduated at Charters Towers School of Mines in Metallurgical Chemistry and Assaying after a three years' Course (1905-1907), for which received School Diploma (under Queensland Mines Department). Appointed Junior Demonstrator in Metallurgical Chemistry and Assaying at Charters Towers School of Mines in September, 1907, and remained in that position till April, 1910, when transferred to the Staff of the Mines Department, Brisbane, which position he still holds.

George J. Saunders.

Charles Walker.

Joseph A. Hughes.

Basil Turner.

J. A. Schofield.

Clark, Leslie Melville,

3, Harley Road, Hampstead, N.W.

Works Chemist. Received the Certificate of Finsbury Technical College, 1910. Senior Student, 1911-1912. Intermediate A.I.C., April, 1912.

R. Meldola.

Reginald F. Easton.

B. H. Buttle.

G. Cecil Jones.

Harley F. Knight.

Das, Bhupati Nath,

Wari, Dacca, Eastern Bengal.

Professor of Inorganic and Physical Chemistry, Government College, Dacca. M.A. in Chemistry (Calcutta University, 1890); B.Sc. (Lond.) with Honours in Chemistry, 1895. Worked under Prof. Carey-Foster, Prof. Sir William Ramsay, and Prof. J. Norman Collie at University College, London, from 1892 to 1896. Professor of Physics and Chemistry in First-grade Government Colleges in Bengal since 1897.

E. R. Watson.

William Ramsay.

P. C. Rây.

N. T. M. Wilsmore.

J. N. Collie.

Davys, Gerard Irvine,

India. (Present address while on leave, Beechview, Kidbrook Grove, Blackheath, London, S.E.)

Captain, Indian Medical Service. B.A., M.D., B.Ch., D.P.H. Honoursman and First Prizeman University Dublin in Physiological Chemistry. Two years special work on the Chemistry of Vermin Destroyers for the Punjab Government. Eight months work at the Chemistry of Food and Drugs, etc., for the D.P.H. Examination. Obtained Diploma of Public Health (Dublin) with Honours in Chemistry, etc.

David Sommerville.

Rhys P. Charles.

Henry L. Smith.

R. Meldola.

Henry Robert Lyell.

Dieffenthaller, George Cruden,

7, Darcueil Lane, Belmont, Port of Spain.

Pharmacist, Trinidad. Educated at St. Mary's College, Trinidad, and passed the Cambridge Local Examinations. Studied Practical and Theoretical Chemistry under the late Professor J. McCarthy, Government Analyst, and passed the examination in this Science. President of the Pharmaceutical Society of Trinidad. Contributed

several papers and lectures on Pharmaceutical subjects, including Native Medicinal Plants, etc., to the Pharmaceutical Society.

A. E. Collens.

E. J. Millard.

John C. Hewlett.

C. Harold Wright.

Joseph de Verteuil.

Fergusson, Donald MacEachern,

c/o Acadia Sugar Refining Co., Ltd., Halifax, N.S.

Analytical Chemist. As Student: First Class Honours Theoretical and Practical Chemistry, Science and Art Department Examinations. Certificates: Organic Chemistry, Magnetism and Electricity, etc., Science and Art Department Examinations. Took regular courses in Bacteriology, Biology, Physical Chemistry, Dalhousie University, Halifax. As Teacher: Assistant Demonstrator, Greenock Science Classes. As Analyst: Public Analysts Laboratory, Greenock, six years. Chemist: Halifax Sugar Refining Co., Ltd.; Acadia Sugar Refining, Co., Ltd., for past ten years, being chief chemist. Member Society of Chemistry Industry, 1902; Member of American Chemical Society, 1904; Vice-President, Nova Scotia Institute of Science, 1910-11, 1911-12.

H. Jermain Creighton.

John Wm. Biggart.

Jno. Peden.

Angus Smith.

Thomas S. Dick.

Foster, Alfred George Ernest,

103, St. Mark's Road, Bristol.

Chemist. Member of the Pharmaceutical Society. Late Demonstrator in Practical Chemistry at Westminster College of Pharmacy. Silver medallist, Chemistry; Bronze medallist, Pharmacy. My reasons for desiring the Fellowship of the Chemical Society have their birth in the wish to be in closer intimacy with research work, and the proceedings of the Chemical Society generally.

Wm. Berry.

H. Wippell Gadd.

H. Sampson Wills.

Albert E. Bell.

Stiles W. G. Rich.

Ernest H. Cook.

Gajjar, Madanlal Jekisandas, M.A.,

Heira House, Girgaum, Bombay.

Assistant Director of Prof. T. K. Gajjar's Technico-Chemical Laboratory (recognised by the Bombay University for post-graduate studies in Chemistry). Professor of Chemistry from the year 1907; lecturing to M.A. and other students of the T. C. Laboratory, after passing the M.A. Exam. (Bombay University) with Chemistry (Second

Class). Head of the Analytical and Consultation Dept. of the Laboratory, and Managing Director of the Ionic Pharmacy.

T. K. Gajjar.

A. R. Normand.

E. M. Modi.

Kapibram H. Vakil.

G. R. Rele.

Gallogly, Michael Francis,

St. Colman's College, Newry.

Clergyman, and Professor of Mathematics, Experimental Physics, and Chemistry. B.A. (Honours), R.U.I. Ten years' experience in teaching above subjects (being for more than eight years in connexion with the Department of Technical Instruction, Ireland). Advanced First Class Certificates in Organic Chemistry, Inorganic Chemistry (Theoretical and Practical), also in Heat, Light, Sound, Magnetism and Electricity, Theoretical Mechanics (from Board of Education).

Emil A. Werner.

Wm. C. Ramsden.

Wm. Caldwell.

A. O'Farrelly.

R. Wright.

Hans Krall.

Sydney Young.

Glegg, Robert,

19, Mount Street, Aberdeen.

Analytical Chemist, and Assistant Lecturer in Agricultural Chemistry (University of Aberdeen and Aberdeen College of Agriculture). Teacher of Chemistry and Physics, Aberdeen School of Pharmacy, 1894-95. Bachelor of Science, Aberdeen University, 1898. Member, Society of Chemical Industry, 1901. Assoc. Institute of Chemistry, 1902; Fellow, 1905. Member, Soc. of Public Analysts, 1908. From July, 1898, to October, 1901, Private Assistant to Mr. Jas. Hendrick, B.Sc., F.I.C., Lecturer in Agricultural Chemistry, Aberdeen University, and Public Analyst. From October, 1901, to February, 1905, Assist. in Laboratory of late Prof. J. Campbell Brown, Public Analyst, Liverpool. Since then Chief Assistant to Mr. Hendrick aforesaid. Work partly in teaching Agricultural Chemistry, partly in analysis of manures, feeding-stuffs, soils, waters, foods and drugs, and general analytical work.

F. R. Japp.

Alexander Lauder.

James Hendrick.

William Maitland.

A. N. Meldrum.

J. Bruce Miller.

Harding, Leonard,

Fern Lea, Russell Street, Eccles.

Chief Chemist to British Engine Boiler and Electrical Insurance Co., Ltd., 12, King Street, Manchester. Analytical Chemist (Technical). Author of original article on "Suction Gas and Low Insulation,"

published in *Electrical Review*. Original work on Selenium Photometer.

B. Prentice.

E. Green.

J. R. Appleyard.

E. Clark.

Jas. W. McMyn.

Hartley, Harold,

Fernbank, Little Switzerland, Douglas, Isle of Man.

Chief Chemist, Richmond Gas Stove and Meter Co., Ltd., Warrington. 1907, B.Sc., First Class Honours in Chemistry, Manchester University; 1908, M.Sc., Manchester University; 1907-9, Gartside Scholar, Manchester University; 1909-12, Gas Institution Research Fellow, Leeds University; 1912, Appointed Chief Chemist, Richmond Gas Stove Co.; 1909-12, "Investigation of Function of Surfaces in Promoting Gaseous Reactions" (in conjunction with Prof. Bone—unpublished).

William A. Bone.

Harold B. Dixon.

Arthur Smithells.

Alfred Holt.

Henry R. Procter.

E. C. Edgar.

Hatherly, Henry Medley,

14, Stackpool Road, Southville, Bristol.

Analytical Chemist. Twelve years with Dr. Ernest H. Cook at the Clifton Laboratory, Bristol. Five years as Articled Apprentice and seven years as Assistant.

Ernest H. Cook.

Francis Francis.

John M. H. Munro.

James W. McBain.

Jas. Steger.

F. W. Risson.

Henius, Max.

1135, Fullerton Avenue, Chicago, Ill., U.S.A.

Secretary, Wahl-Henius Institute of Fermentology, Chicago. Ph.D., University Marburg, Germany; Instructor Brewery practice and Mathematics for twenty years; co-author of *American Handy Book on Brewing, Malting, etc.*

Charles B. Davis.

A. Chaston Chapman.

Horace T. Brown.

Adrian J. Brown.

Arthur R. Ling.

Heron, Harold,

110, Fenchurch Street, London, E.C.

Brewer's Analyst and Consulting Chemist. I have been occupied for thirteen years as chemist and analyst as under: Five years as Assistant to John Heron, F.I.C., F.C.S., 110, Fenchurch Street, London, E.C. Five years as Chemist to Messrs. Fowler, Ltd., Sugar

Refiners, London. Two years associated in partnership with John Heron, F.I.C., F.C.S.

John Heron.

A. Chaston Chapman.

Otto Hehner.

Charles A. Keane.

Horace T. Brown.

Holden, Edmund Haworth,

25, Curwen Street, Workington, Cumberland.

Science Master, Workington Secondary School, and Lecturer in Chemistry and Metallurgy, Technical School, Workington, from October 1st, 1909, to the present time. Assistant, Wigan Mining and Technical College, January, 1908, to September, 1909. Graduated B.Sc. (Vict. Univ. of Manchester, 1905, Chemistry and Physics); M.Sc., Vict. (1907, in Chemistry).

Harold B. Dixon.

Norman Smith.

W. H. Perkin

R. Robinson.

E. C. Edgar.

A. Lapworth.

James, Edward Lewis,

Holly Lodge, Larkhall Rise, Clapham, S.W.

Chemistry Master, Sir Walter St. John's Secondary School, Battersea. To keep up to date in chemical knowledge.

Alex. McKenzie.

G. W. Clough.

Leonard Temple Thorne.

F. Barrow.

E. Haynes Jeffers.

Geoffrey Martin.

John Wilson.

Raphael Meldola.

W. T. Lattey.

James, Edwin Oliver (Rev.),

The Curatage, Low Moor, Yorks.

Clerk in Holy Orders. For sometime Assistant Master and Science Lecturer. Science student at University College, London. Author of "God's Eight Days of Creation." Work on Chemistry, and thesis on "Chemistry of Life," in course of preparation.

William Ramsay.

William Briggs.

J. W. Shepherd.

J. C. Mascarenhas.

Samuel F. Stell.

Jewell, William,

44, Highfield Road, Dartford, Kent.

Chemist. Associate of the Institute of Chemistry. Demonstrator at the Technical College, Finsbury; and at present engaged as Chemist at Messrs. Burroughs Wellcome & Co., Dartford.

Raphael Meldola.

Frank Lee Pyman.

Francis H. Carr.

W. H. Taylor.

Frederick B. Power.

Keenan, Thomas John,

751, East Nineteenth Street, Brooklyn, N.Y., U.S.A.

Managing Editor of *Paper*, New York. Author of numerous papers and pamphlets on pharmaceutical chemistry, toxicology, new remedies, radioactive bodies, antiseptics, disinfectants, materia medica (organic and inorganic) in the *Pharmaceutical Record*, 1890-1892, and *American Druggist*, 1892-1911. At present engaged in work as paper technologist and cellulose chemist. Editing the weekly journal of paper technology, "*Paper*."

Chas. Baskerville.

Peter MacEwan.

Fred. W. Fletcher.

William Mair.

Thos. Stephenson.

Kuntzen, Harold Eric,

Doric Lodge, Clapton Common, London, N.

Chemist. Co-author with Prof. R. Meldola, F.R.S., of the following: "Syntheses with Phenol Derivatives, Part III and Part IV." "Salts and Ethers of 2:3:5-Trinitro-4-acetylaminophenol, etc."

R. Meldola.

G. T. Morgan.

John Joseph Eastick.

M. O. Forster.

B. E. R. Newlands.

Langton, Harold McKee,

80, Kingston Road, Ilford, Essex.

Science Teacher under the London County Council. B.Sc. (London). Science Teacher (Chemistry) for one year under London County Council. Lecturer and Demonstrator for one year in Chemistry at East Ham Technical College. Two and a-half years' experience in research work under Dr. A. E. Dunstan.

A. E. Dunstan.

F. B. Tholo.

E. D. Griffiths.

W. H. Barker.

R. W. Wilson.

Macdonald, James Leslie Auld,

13, Howard Place, St. Andrews, Fifo, N.B.

Bachelor of Science (St. Andrews). Chemical Research Student, St. Andrews University. Formerly Assistant Manager and Chemist to the Oak Extract Company, Ltd. (of London) at their factory in Zupanjé, Slavonia, Austria-Hungary. At present engaged upon a research on the "Nature of the Condensation of Acetone with Glycerine and other Polyhydroxy-compounds" in the Chemical Research Laboratory, St. Andrews University.

J. C. Irvine.

Thomas Purdie.

William S. Denham.

G. Druce Lander.

Arthur W. Crossley.

Masani, Nadirshaw Adarji,
Baroda Camp, India.

Professor of Chemistry, Baroda College. Head of the Department of Chemistry, Baroda College. Master of Arts and Bachelor of Science of the Bombay University.

T. K. Gajjar.

Alex. R. Normand.

E. M. Modi.

G. R. Rele.

Kapibram H. Yakil.

Meadon, Percival Edward,
6, Stanley Road, Oxford.

Assistant Education Secretary, Oxford County Council. B.A. Oxon. (Chemistry), St. John's College. Formerly Teacher, now Assistant Education Secretary.

W. W. Fisher.

P. Elford.

A. F. Walden.

J. E. Marsh.

B. Lambert.

Meister, Frederick James,
1, Stanley Terrace, Alva.

Analyst. I studied chemistry under the late Mr. Aitken, lecturer in Edinburgh University and Royal Dick College, for a period of some six years, during which time I was actively engaged in analytical work, practical and theoretical chemistry, etc. I assisted Mr. Aitken in his lectures and practical classes both in the Dick College and University, also taking classes in botany and zoology, bacteriology, etc. I left Mr. Aitken to go as a chemist to Messrs. the Distillers Co., Ltd., Edinburgh, with whom I have been some twelve years, where I hold the position of chief chemist and director of laboratory. I have spent all my time in the fermentation industries, also having gone abroad several times to enquire into Continental conditions, etc., of the fermentation industries.

Stevenson Macadam.

G. H. Gemmell.

J. Wyclif Black.

J. Falconer King.

A. Scott Dodd.

Menzies, Robert Charles,
27, Cluny Drive, Edinburgh.

Student of Chemistry. Studied chemistry in Cambridge for four terms under Dr. H. J. H. Fenton, F.R.S. Since 1910 have been studying for the degree of B.Sc. in the University of St. Andrews, and now desire to become a Fellow of the Society, as I hope to commence research work next term.

J. C. Irvine.

Hugh Marshall.

William S. Denham.

G. Druco Lander.

Thomas Purdie.

Morgan, Sidney,

Rubber Growers' Association Laboratory, Pataling, Kuala Lumpur, Fed. Malay States.

Analytical Chemist. Assistant to Messrs. Clayton Beadle and Stevens, Kuala Lumpur, F.M.S. Associate of Royal College of Science.

Henry P. Stevens.

M. O. Forster.

Clayton Beadle.

G. T. Morgan.

James C. Philip.

W. Godden.

A. Clayton.

Pearson, George Ernest,

Prospect Cottage, Sutton, near Hounslow.

Works Chemist. Pharmaceutical Chemist. Member, Pharmaceutical Society; Chief Chemist to Baiss Bros. & Stevenson, Ltd.

John C. Umney.

C. T. Bennett.

Peter MacEwan.

Walter F. Reid.

Thomas Tyrer.

N. H. Martin.

W. L. Howie.

Rideal, Eric Keightley,

28, Victoria Street, S.W.

Chemical Student in the Research Laboratory of Electrochemistry at Aachen, Germany. B.A. Cantab (Honours in Chemistry).

E. Grant Hooper.

W. R. Hodgkinson.

Thos. Tyrer.

H. J. H. Fenton.

H. O. Jones.

Shaw, William Daveridge Hamilton,

c/o The Coppée Coke Oven Co., Ltd., King's House, Kingsway, W.C.

Technical Chemist. Student (Inorganic Chemistry, Organic Chemistry, Metallurgy) at University College, Cardiff, 1899-1903. Lecturer in Chemistry at Rutherford College, Newcastle-on-Tyne, until April, 1912. Now as above. B.Sc. Diploma in Metallurgy (Wales).

Claude M. Thompson.

Clarence A. Seyler.

E. P. Perman.

John W. Bevan.

A. A. Road.

Thévenaz, William,

48, Grey Street, Hull.

Manufacturing Chemist. Chimiste diplômé and docteur-ès-Sciences physiques et chimiques of the University of Geneva (Switzerland).

Paul Haas.

F. N. Kay Menzies.

R. H. A. Plimmer.

Samuel Smiles.

Arthur W. Crossley.

Thomas, William Leonard,
10, Victor Road, Bradford.

Analytical Chemist. Bradford Technical College, 1905-1906.
Technical Chemist, Woolcombers, Ltd., Bradford.

Walter Leach. A. Battye Knaggs.

Walter M. Gardner. B. A. Burrell.

Barker North. T. Fairley.

Waters, Percy Wharton,
Glenbervie, Melrose Avenue, Brooklands, Cheshire.

Analytical Chemist. Studied Chemistry for five years, and two years Assistant to Lester Reed, Esq., F.I.C., Borough Analyst for Croydon.

Lester Reed. Ceeil H. Cribb.

A. J. de Hailes. Walter Tong.

Samuel Rideal.

Williams, George Mason,
17, Springcroft Avenue, Muswell Hill, N.

Manufacturing Chemist. Late pupil of Mr. P. A. Ellis Richards in Chemistry at Charing Cross Hospital Medical School. I am making a speciality of Lecithin and its preparations, and am most anxious to become a Fellow of the Chemical Society in order that I can attend the Lectures and have the use of Library, etc.

Ernest J. Parry. P. A. Ellis Richards.

Edwin Harrison. C. T. Bennett.

John. C. Umney.

The following Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3):

Dutta, Jatindra Mohan,
Dacca, 145, Laksmibazar (E. Bengal, India).

Research Scholar, Dacca College, Chemical Laboratory, Dacca. M.A. of the Calcutta University, Bengal, India. Special Research Scholar of the Government of Eastern Bengal and Assam, India. Jointly written the following papers: (1) "The Relation between the Chemical Constitution of Monazo-dyes and their Fastness to Light" (*Abst. Pros. C. S.*, vol. 25, 1909, p. 290; *J. Soc. Dyers and Col.*, 26, 237-8). (2) "The Relation between the Chemical Constitution of Monazo-dyes and Fastness to Light and Other Agencies" (*J.S.C.I.*, Jan. 15, 1911, p. 9). (3) "On Knecht's Process for Estimating

Azo-dyes on Textile Fabrics." (4) "The Reaction between Permanganate of Potash and Manganese Sulphate in Acid Solution" (*Abst. Pros. C. S.*, vol. 25, 1909, p. 249; published in *Zeitschrift für anorganische Chemie*, June 14, 1910). (5) "The Relation between Chemical Constitution and Fastness to Light and Other Agencies of Polyhydroxybenzophenone Dyes" (*J.S.C.I.*, Feb. 28, 1911). (6) "Some Hydroxy-ketonic Dyes" (submitted for publication to the Chemical Society, London).

E. R. Watson.

Sircar, Anakul Chandra,

Chemical Laboratory, Dacca College, Dacca, East Bengal, India.

Research Student, Dacca College, Dacca, India. Second Class M.A. in Chemistry, Calcutta University, Eastern Bengal, and Assam Govt. Research Scholar, 1909-1911. Prem Chaud Roy Chaud Research Scholar (Calcutta University), 1910. Mout Gold Medallist (Calcutta University), 1910. Research Student, Dacca College. Joint author of the following original papers: (1) "The Relation between the Chemical Constitution and Fastness of Azo-dyes to Light" (*Chem. Soc. Proc.*, 1909, 25, 224; *J. Soc. Dyers and Colourists*, 26, 237-38). (2) "The Relation between the Chemical Constitution of Monazo-dyes and Their Fastness to Light and Other Agencies" (*Journal of the Soc. of Chem. Ind.*, Jan. 16, 1911). (3) "The Reaction between Permanganate of Potash and Manganese Sulphate in Acid Solution" (*Zeitschrift für anorganische Chemie*, June 14, 1910). (4) "Azo-salicylic and Azo-oxynaphthoic Acid Dyes" (has been sent to the Chemical Society). (5) "On Knecht's Process for Estimating Azo-dyes in Textile Fabrics."

E. R. Watson.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 404.

Thursday, June 20th, 1912, at 8.30 p.m., Dr. M. ONSLOW FORSTER, F.R.S., Vice-President, in the Chair.

Messrs. Bertram Lambert, Edgar A. Rayner, and J. W. Patterson were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Edwin John Amies, B.Sc., 10, Salisbury Road, Thorpe Hamlet, Norwich.

William Llewelyn Bailey, Central Buildings, Matlock.

Edmund Arthur Buckle, Beech Villa, Guest Road, Prestwich, Manchester.

Ridsdale Ellis, B.Sc., 20, Queen's Square, Bloomsbury, W.C.

Arthur James Hale, B.Sc., 53, Gowrie Road, Lavender Hill, S.W.

Archie Haydon, 55, Grove Lane, Kingston-on-Thames, Surrey.

Edward Hope, M.Sc., Lockingstoops, Lowton, Newton-le-Willows.

Herbert Carr Roper, 42, Cavendish Place, Newcastle-on-Tyne.

A Certificate has been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Mr. Francis Maxwell, 77, Lawrie Park Road, Sydenham, and Credit Foncier, Mauritius.

A Ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

Thomas Allcock.	Max Henius, Ph.D.
Raymond Theodore Fred Barnett, B.Sc.	Harold Heron.
Charles James Vinall Bews, B.Sc.	Edmund Haworth Holden, M.Sc.
Cyril Douglas Birks.	Edward Lewis James.
William Henry Bowater.	Edwin Oliver James.
Harry Brindle.	William Jewell.
Alfred Varlow Campbell.	Thomas John Keenan.
Arthur Fred Campbell, M.Sc.	Harold Eric Kuntzen.
Bamacharan Chatterji, M.A.	Harold McKee Langton, B.Sc.
Frank Lothian Cheshire.	James Leslie Auld Macdonald, B.Sc.
Leslie Melville Clark.	Nadirshaw Adarji Masani, M.A., B.Sc.
Bhupati Nath Das, M.A., B.Sc.	Percival Edward Meadon, B.A.
Gerard Irvine Davys, B.A., M.D., B.Ch., D.P.H.	Frederick James Meister.
George Cruden Dieffenthaler.	Robert Charles Menzies.
Jatindra Mohan Dutta, M.A.	Sidney Morgan.
Donald MacEachern Fergusson.	George Ernest Pearson.
Alfred George Ernest Foster.	Eric Keightley Rideal, B.A.
Madanlal Jekisandas Gajjar, M.A.	William Daveridge Hamilton Shaw, B.Sc.
Michael Francis Gallogly, B.A.	Anukul Chandra Sircar, M.A.
Robert Glegg, B.Sc.	William Thévenaz, D. és Sc.
Leonard Harding.	William Leonard Thomas.
Harold Hartley, M.Sc.	Percy Wharton Waters.
Henry Medley Hatherly.	George Mason Williams.

Of the following papers, those marked * were read:

***160. "The formation of neon as a product of radioactive change."
By Sir William Ramsay, K.C.B.**

The discovery that there is one hundred and eighty-eight times as much neon in the radioactive gas from the King's Well at Bath as in atmospheric air led to a repetition of experiments made by the author some years ago with Mr. Alexander Cameron, in which it was shown that when niton decomposes in presence of water, neon is one of the products. This conclusion has been questioned; the presence of neon has been ascribed to leakage of air into the apparatus; and Mr. Soddy has shown that it is possible to detect by the use of a spectroscope, the neon separated from 0.2 c.c. of air. The author has now proved that a leakage of at least 4 c.c. of air into the bulb, or during the processes of separation, would be necessary in order to account for the quantity of neon found; and as a proof that air had not leaked in, argon was tested for in the gases, and was found to be practically absent.

It is remarkable that although the water of the King's Well is fairly radioactive, neither free hydrogen nor free oxygen were

present in the gases bubbling out of the water. It is difficult to account for this, in face of the presence of a relatively large proportion of helium in the gases; the proportion is seventy-three times that normally present in air.

DISCUSSION.

Prof. TRAVERS said that some years ago, when he and Sir William Ramsay were searching for unknown inactive gases, they visited the Cauterets in the South of France, and collected samples of gas from several of the springs. The inactive fractions of these gases showed only the spectra of argon and helium. They were not, however, subjected to fractionation; and later, when the methods of dealing with liquefied gases had been worked out, and neon had been discovered, the samples had been lost.

*161. "An analysis of the waters of the thermal springs of Bath."

By Irvine Masson and Sir William Ramsay, K.C.B.

Analyses were given of the gases escaping from these waters; they consist of carbon dioxide (36.0 c.c.), nitrogen (954 c.c.), argon (7.263 c.c.), neon (2.334 c.c.), and helium (0.297 c.c.) per litre. There is no hydrogen or oxygen present. There is 0.78 times as much argon, 188 times as much neon, and 73 times as much helium as there is in atmospheric air. The gas also contained niton in a million litres, in equilibrium with 33.65 milligrams of radium. An analysis was also given of the dissolved solids; the chief constituent is calcium sulphate, and it may be noted that lithium, strontium, and bromine are also present. There is also a trace of dissolved radium.

DISCUSSION.

Mr. CHAPMAN said that he gathered from the authors that the ratio of iron to lime was much larger in the recent than in the ancient deposits, and suggested that if that were the case it would appear to indicate that the water had undergone some appreciable change in respect of its mineral constituents.

Sir W. RAMSAY replied that the surface formation was oolitic; but the water came from an unknown depth, and the nature of the rock was unknown. The nearest known deposits of pitchblende were in Cornwall, about 150 miles to the south-west. He also pointed out that persons with a delicate sense of smell had told him that the water had a faint odour of bleaching powder.

Mr. MASSON said that comparison with two other analyses made during the past forty years showed that the composition of the mineral content of the water varied considerably.

***162. "The colour intensity of copper salts."**

By Spencer Umfreville Pickering.

The colour intensity of copper in solutions of inorganic salts is practically a constant (taken as unity), and is unaffected by dilution. In cupri-compounds it is about 19 with the strongest solutions of which accurate measurements can be made, and generally diminishes on dilution, but is sometimes constant. These two values are explained as applying to bivalent and quadrivalent copper respectively, and the variation in colour intensity of all copper salts can be explained by their solutions containing the normal salt or the "cupri"-form of it (with quadrivalent copper) in varying proportions. Both these forms have been isolated and examined in the case of the glycerate and racemate. Such a view harmonises with the results of electrolysis, and with the coloration of iron and manganese when their valency is altered.

DISCUSSION.

Dr. P. W. ROBERTSON said that the work of Hantzsch and his collaborators had shown that the only trustworthy method of measuring the colour of a solution was to determine the absorption in different parts of the visible spectrum by means of a spectral photometer; to establish optical identity it was necessary also to show that the absorption curves coincided in the ultraviolet. Cases were known where solutions differing appreciably in tint (the eye being extremely sensitive in certain portions of the spectrum), nevertheless gave on measurement absorption-coefficients practically the same; this was caused by a slight shifting of an absorption band. Other cases were known where solutions which appeared similar to the eye gave at the edge of the spectrum absorption-coefficients widely different; this was due to the appearance of a band just within the visual region. Finally, there were cases where a solution which obeyed Beer's Law, that is, which had an absorption-coefficient remaining the same on dilution, had a totally different colour when diluted or when examined in thin layers; this phenomenon was due to the existence of a flat band near the centre of the visible spectrum. These facts indicated that the direct vision method of comparing colour must be used with considerable caution.

Mr. PICKERING said that objections existed to the spectroscopic method (Sidgwick and Tizard, *Trans.*, 1908, **93**, 195), as well as to the use of the tintometer. Sidgwick and Tizard's results established the practical identity of the blue coloration, and its practical independence of dilution in the case of the sulphate, chloride,

bromide, and nitrate, but some solutions of copper salts were not blue at all. The independence of dilution in the case of the sulphate now appeared to be absolute. That Sidgwick and Tizard's results were affected by some source of error was shown by the fact that they indicated in the case of the organic salts a much higher value at infinite dilution than that actually realised now with very weak solutions. The change of valency of the copper atom without oxidation was similar to that recognised as occurring in the case of the halogens nitrogen, oxygen, etc. The group $C(OH)_2$ would not necessarily confer strong acidic properties any more than in the case of other hydrates.

***163. "Nitrites of the mercurialkyl- and mercurialkylaryl-ammonium series. Part II."** By Prafulla Chandra Rây, Nilratan Dhar, and Tincowry De.

From the measurements of their electric conductivities it is found that mercurihexamethylenetetra-ammonium and mercuriethylenediammonium nitrites belong to the ammonium type as they behave like the alkali nitrites.

***164. "Studies of dynamic isomerism. Part XIII. Camphorcarboxylamide and camphorcarboxypiperidide. An illustration of Barlow and Pope's hypothesis."** By Walter Hamis Glover and Thomas Martin Lowry.

The preparation of these two substances was described in a preliminary note in 1910 (*Proc.*, **26**, 162). By the slow evaporation of solutions in ethyl acetate, well-formed crystals have now been prepared. The amide is monoasymmetric: $a:b:c=1.4736:1:1.7683$ or $0.7368:1:0.8841$; $\beta=61^\circ 2'$. The piperidide is orthorhombic and hemihedral: $a:b:c=1.5032:1:2.4320$ or $0.7516:1:1.2160$. Whilst there is only an approximate morphotropic relationship between these two compounds, a remarkable agreement is found to exist between the parameters of the amide and those of the less stable form of Forster's α -benzoylcamphor, thus:

	Valency volume.	Equivalence parameters.
$C_{10}H_{15}O \cdot CO \cdot NH_2$	68	3.627 : 4.923 : 4.352
$C_{10}H_{15}O \cdot CO \cdot C_6H_5$	92	3.658 : 4.960 : 5.071

The significance of these relationships was discussed.

- *165. "Studies of dynamic isomerism. Part XIV.² Successive isomeric changes in camphorcarboxylamide and camphorcarboxypiperidide." By Thomas Martin Lowry and Walter Hamis Glover.

Well-formed crystals of camphorcarboxylamide, whether separated from ethyl acetate or from benzene, are almost inactive when freshly dissolved in alcohol or in benzene, but increase rapidly in rotatory power to $[\alpha]_{5461} = 100^\circ$ in alcohol and 70° in benzene. The initial solubility of these crystals in heptan \bar{e} does not exceed 0.24 gram per 100 grams of solvent, as contrasted with 0.38 gram for the minute crystals which separate from light petroleum. By similar methods the initial solubility of the piperidide is reduced from 2.06 to 1.64 grams per 100 grams of heptane.

Both substances give rise to inflected mutarotation curves. These are too complex to be accounted for by two successive unimolecular changes, and point to the existence of three or more isomeric changes involving four or more isomeric forms of each substance.

- *166. "The continuous fractional distillation of water."
By William Robert Bousfield.

In accurate work on the conductivities of dilute aqueous solutions it is recognised that the water employed should approximately have a conductivity which is represented by $K_{18} = 1 \times 10^{-6}$. In a former paper (*Trans.*, 1905, 87, 740) the author described an apparatus by means of which water of this order of purity could be produced by continuous fractional distillation from "tap water," that is to say, the ordinary town-water supply. There were now described two forms of apparatus, constructed on the same principles, but simplified, and more easily managed. The first of these presents great advantages as a still for every-day use, yielding about 30 litres of water a day (working day and night), two-thirds of which has a conductivity of about 0.8, the remainder being distilled water of ordinary character. The foregoing result is produced without the use of chemicals. If a strongly alkaline solution of potassium permanganate is supplied with the feed-water at the rate of about 10 drops a minute, water of a slightly lower conductivity can be continuously produced. The other apparatus, which may be referred to as the three-bottle apparatus, is suited for the continuous redistillation of water under diminished pressure. By

the use of this apparatus, water having a conductivity of 0.5 may be continuously produced by the redistillation of the ordinary product of the first still.

167. "Studies on certain aliphatic hydroxy-acids." By Henry John Horstman Fenton and William Arthur Reginald Wilks.

The authors are continuing the study of the oxidation of various organic substances in presence of ferrous iron as catalyst, and of the properties and relationships of the products. An account was given of (1) the transformation of oxalacetic acid into dihydroxy-maleic acid, (2) the isolation of bromo-oxalacetic anhydride (or bromo-hydroxymaleic anhydride), (3) the tautomeric dihydroxy-maleic esters, (4) "aldehydo-glyceric" acid, and (5) the products obtained by condensation of these substances, and others, with carbamide.

168. "Formation of seven- and eight-membered rings from 2:2'-ditolyl." By James Kenner.

In continuation of the work already described, on ring-formation with the aid of derivatives of 2:2'-ditolyl, it has now been found that the behaviour of $\omega\omega'$ -dibromo-2:2'-ditolyl towards diethyl malonate and tetraethyl ethanetetra-carboxylate is similar to that of *o*-xylylene dibromide (compare Kenner and Turner, *Trans.*, 1911, 99, 2107).

Dibenzocycloheptadienedicarboxylic acid, $\begin{matrix} \text{C}_6\text{H}_4\cdot\text{CH}_2 \\ \text{C}_6\text{H}_4\cdot\text{CH}_2 \end{matrix} > \text{C}(\text{CO}_2\text{H})_2$,

forms prisms which melt at 205°, and decompose into carbon dioxide and *dibenzocycloheptadienemonocarboxylic acid*, m. p. 157.5°; the *methyl* ester of the latter acid is a highly refractive, viscous liquid, b. p. 288°/181 mm., and gradually solidifies to radiate masses of thin plates.

Tetraethyl dibenzocyclooctadienetetracarboxylate forms rhombic crystals, m. p. 108°.

The reactions of these and other derivatives from 2:2'-ditolyl are under investigation.

169. "Contributions to the chemistry of the terpenes. Part XIII. The preparation of pure bornylene." By George Gerald Henderson and William Caw.

The best method of obtaining bornylene in quantity is to decompose methyl bornyl xanthate, which is easily prepared from borneol,

by heating to a temperature not exceeding 200° , but the product contains a certain proportion of an isomeric terpene (either cyclene or camphene), and hitherto no satisfactory process of removing this impurity has been described. It has now been found that crude bornylene can be completely purified by treatment, under suitable conditions, with a limited quantity of hydrogen peroxide, and that the yield of the pure hydrocarbon is at least 60 per cent. of the original material.

170. "The interaction of bromine and the sulphides of β -naphthol."

By Thomas Joseph Nolan and Samuel Smiles.

The interaction of bromine and the stable and unstable sulphides of β -naphthol was described. The former yields 2:6-dibromo- β -naphthol, whilst the latter furnishes dibromonaphthasulphoniumquinone, in which the substitution is homonuclear. The latter compound was also obtained by bromination of the sulphonium-quinone. It was concluded that the situation of the thio- and hydroxyl group in either sulphide is the same, and that the stable sulphide behaves as a true derivative of β -naphthol, whilst in the unstable sulphide the naphthalene nucleus behaves similarly to that in the sulphonium-quinone. Whether this peculiar behaviour of the latter compound is due to preliminary oxidation to the quinone will be decided by future experiments.

171. "The absorption spectra of some substances containing two benzene nuclei." By John Edward Purvis and Nial Patrick McClelland.

A description was given of the absorption spectra of solutions of some hydrocarbons, ketones, amines, and ethers consisting of two benzene nuclei united by a chain of other groups. The mutual effect on one another of the two benzene nuclei and other oscillation centres in the molecule was discussed.

The bands observed in the vapour of anisole at various temperatures and pressures were also described, and compared with the solution bands.

172. "The influence of the constitution of tertiary bases on the rate of formation of quaternary ammonium salts." (Preliminary note.) By Ebenezer Rees Thomas.

Although some investigations have been carried out on the rate of combination of a few tertiary bases with various alkyl haloids, no accurate measurements have as yet been made of the rate of

formation of quaternary ammonium salts from tertiary aromatic amines of the type $C_6H_5 \cdot NXY$.

It was considered of interest to investigate the effect which the nature of the groups X and Y would have on the rate of such a reaction. No "heterospasis" or any such effect as Clarke describes (*Trans.*, 1910, **97**, 416) was observed with carefully purified reagents. The reaction was carried out at 40° with *N*/10-absolute alcohol solution, the quaternary ammonium bromide being estimated gravimetrically as silver bromide.

The rates ($k \times 10^3$ given in each case) for dimethylaniline (1.076), diethylaniline (0.094), methylethylaniline (0.660), methylallylaniline (0.324) with allyl bromide have been determined.

The results led to a study of dimethyl-*o*-toluidine (0.0573), dimethyl-*m*-toluidine (1.42), *p*-bromodimethylaniline (0.284), quinoline (0.0584), isoquinoline (0.450), pyridine (0.40), and 2-methylquinoline (0.0324). In some cases the reaction-velocity for benzyl bromide was also determined, and was in nearly every case related to that for allyl bromide in the ratio of about 6:1.

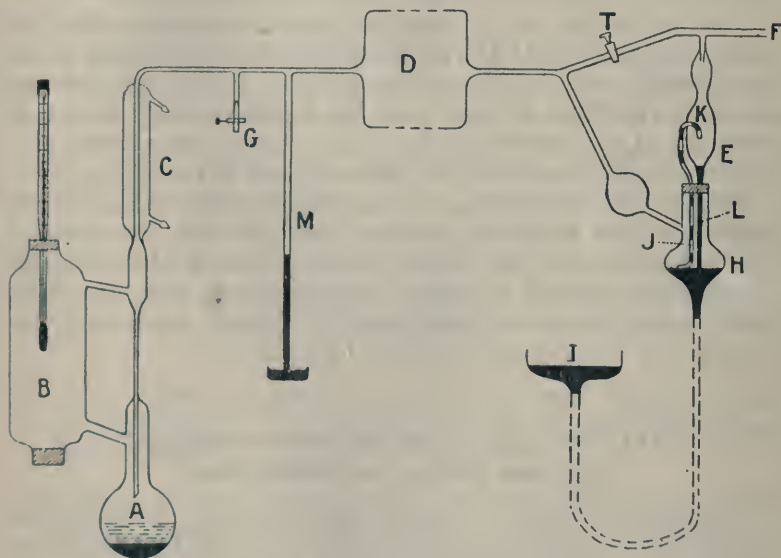
The effect of unsaturation of the attached groups on the residual affinities of the tervalent nitrogen atom has also been studied. The indications as to the influence of the strength of the base on its reactivity are not of a very definite nature, any such effect being in many cases completely masked by steric hindrance. The investigation is being continued and extended.

173. "An easily adjustable vapour thermostat."

By James Fletcher and Daniel Tyrer.

The authors described a vapour-bath which can be maintained constant with very little trouble to 0.005° , and can be fixed at any desired point (say, between 30° and 130°) with the greatest ease. In principle it consists of a pure liquid boiling under a constant and adjustable pressure, which is controlled and maintained constant by a very efficient manostat. Practically any liquid of suitable boiling point may be used. The boiling liquid is contained in the flask *A* (see diagram). The vapour passes into the compartment *B*, which may be of any particular form suitable; *B* also contains a thermometer, as shown. The vapour is then condensed in *C*, and returns as liquid to the boiling flask *A*. The end of the condenser *C* is connected, as shown, with an air reservoir *D*, of about 10—20 litres capacity (the larger the size of this reservoir the greater is the efficiency of the apparatus), and then to the manostat *E*. The manostat being the most important part of the apparatus may be described at some

length, and for the sake of clearness has been drawn in the diagram on a rather large scale. The tube *F* is attached to an efficient water-pump. The degree of exhaustion is first roughly adjusted by allowing air to enter by the side-tube and pinch-cock *G*. The mercury rises into the bulb *H* out of the reservoir *I* until the level reaches the end of the tube *J*, when it stops and remains constant. If it passes this point it closes off the rest of the apparatus from the pump, and as air is entering through the side-tube *G* the pressure increases and the level of the mercury in the manostat falls again. As soon as the end of the tube *J* becomes uncovered, the pump again comes into play and rapidly reduces



the pressure, causing the mercury level to rise again. When equilibrium is reached the level of the mercury remains constant, and a continual current of air and mercury passes up the tube *J* into the compartment *K*, from whence the mercury falls back into the bulb *H* by the tube *L*, and the air passes off through the pump. It will be clear that the difference in the levels of the mercury in *H* and *I* represents the pressure in the apparatus, and the adjustment of this pressure is made by merely altering the height of the reservoir.

For the proper working of the manostat it is necessary to have a large air supply to draw from; otherwise the mercury level in *H* rises and falls irregularly. This is the purpose of the air reservoir *D*. Although the level of the mercury in *H* may fluctuate

slightly, the pressure recorded by the manometer *M* remains perfectly constant. In order to raise the temperature in *B*, the mercury reservoir *I* is raised, and to lower the temperature it is merely necessary to lower *I*.

For the efficient working of the apparatus attention must be paid to the following details: The reservoir should be shallow, so that if the vessel *K* partly fills with mercury, as sometimes happens, the difference in the mercury levels in *H* and *I* is not appreciably altered. The end of the tube *J* should be a narrow slit not wider than 0.5 mm., and bent horizontally. The width of this slit ensures that the greatest possible variation in the pressure is 0.5 mm., although the actual variation need not exceed 0.1 mm. In order to accelerate the initial exhaustion of the apparatus the tap *T* is provided as a by-pass, which at all other times must be closed. The connecting tubes should be of wide bore, so that the pressure at all parts of the apparatus is absolutely the same.

The boiling liquid used must be pure, and must boil quietly without bumping. It is found that bumping is prevented, however low the pressure, by placing in the flask *A* a layer of mercury as indicated. It is better to boil the liquid over a small free flame shielded from draughts. If the efficiency of the water-pump varies considerably, and if it is desired to have a very constant temperature, it is better to use two manostats connected together with an air reservoir and air inlet tube between them. The temperature can, however, be maintained constant to about 0.01° with one manostat.

Change of the atmospheric pressure affects the constancy of the temperature, and to a smaller extent change of the room temperature owing to the alteration in the density of the mercury. These influences must be obviated by personal observation and adjustment.

If rubber stoppers are used, an alcohol should be employed as the boiling liquid, but with ground-glass connexions lubricated with glycerol-dextrose mixture any liquid can be used. For temperatures ranging from 30° to 65° the authors recommend methyl alcohol, from 40° to 70° ethyl alcohol or benzene, and for higher temperatures toluene or xylene.

In experiments made with a Beckmann thermometer in *B* and with a double manostat, it was found that for short periods of time the temperature remained constant to 0.001°. For longer periods the variation is greater, but so long as the atmospheric pressure remains unchanged the temperature remains constant to about 0.005°.

This form of thermostat has many advantages over the usual large water-bath. It is more quickly adjustable, and need not be left going for long periods of time, as it is only a matter of a few minutes to start it again.

174. "Contributions to our knowledge of semicarbazones. Part I. Semicarbazones of phenyl styryl ketone." By Isidor Morris Heilbron and Forsyth James Wilson.

The authors have extended their investigations, of which a preliminary account has appeared (*Proc.*, 1911, 27, 325). They find that phenyl styryl ketone is apparently capable of yielding four semicarbazones, two white and two yellow, and adduce reasons for regarding these forms as stereoisomerides. The absorption spectra of the various modifications have been investigated, and the effect of ultra-violet light on the different forms has also been studied.

175. "The essential oil of 'Nepal sassafras' or 'Nepal camphor' tree." By Samuel Shrowder Pickles.

The essential oil from the wood of the Indian tree *Cinnamomum glanduliferum*, Meissn, has been examined and found to have the following general characters: D_{15}^{20} 1.1033; α_D^{20} $-0.4''$ (in a 1-dm. tube); saponification value, 2.8; saponification value after acetylation, 7.0.

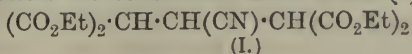
The oil is pale yellow, and possesses an odour resembling safrole with, however, a suggestion of anise. The yield obtained from the dried ground wood by steam distillation was 4.16 per cent. The oil is soluble in half its volume of 90 per cent. alcohol, and in five volumes or more of 80 per cent. alcohol.

An exhaustive examination showed the oil to consist mainly of safrole, myristicin, and elemicin. Other constituents, present in small quantities, are palmitic acid (m. p. 62.5°), esters of the lower fatty acids, and traces of phenols.

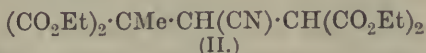
176. "The addition of hydrocyanic acid to derivatives of glutaconic acid and itaconic acid." (Preliminary note.) By Edward Hope.

In extending the application of the method employed for the synthesis of β -methyltricarballic acid (*Trans.*, 1912, 101, 899), the author has investigated the addition of hydrogen cyanide to the following substances: ethyl itaconate, ethyl teraconate, ethyl glutaconate, ethyl $\alpha\gamma$ -dicarbethoxyglutaconate, ethyl $\alpha\gamma$ -dicarbethoxy- α -methylglutaconate, and ethyl γ -cyano- $\alpha\beta$ -dimethylglutaconate.

In the case of ethyl itaconate the reaction proceeds quantitatively with the production of *ethyl γ -cyanopropane- $\alpha\beta$ -dicarboxylate*, $\text{CO}_2\text{Et}\cdot\text{CH}_2\cdot\text{CH}(\text{CO}_2\text{Et})\cdot\text{CH}_2\cdot\text{CN}$, which boils at $171^\circ/18\text{ mm.}$, and on hydrolysis gives an almost quantitative yield of tricarballic acid. In the cases of ethyl teraconate and ethyl glutaconate, no appreciable addition of hydrogen cyanide has yet been observed to occur. Ethyl $\alpha\gamma$ -dicarbethoxyglutaconate and ethyl $\alpha\gamma$ -dicarbethoxy- α -methylglutaconate readily combine with the elements of hydrogen cyanide, yielding esters of very high boiling point which probably possess the constitutional formulæ (I) and (II) respectively:



(I.)



(II.)

The ester (I) on hydrolysis gives a large yield of tricarballic acid and (II) an equally good yield of the isomeric α -methyltricarballic acids.

Ethyl γ -cyano- $\alpha\beta$ -dimethylglutaconate readily combines with hydrogen cyanide with the production of *ethyl $\gamma\delta$ -dicyanoisopentane- $\beta\delta$ -dicarboxylate*, $\text{CH}_3\cdot\text{CH}(\text{CO}_2\text{Et})\cdot\text{CMe}(\text{CN})\cdot\text{CH}(\text{CN})\cdot\text{CO}_2\text{Et}$, a viscid oil boiling at $200\text{--}206^\circ/20\text{ mm.}$

The general behaviour of these additive products and of others prepared by similar methods is under investigation, and it is hoped that these compounds will afford methods for preparing many hitherto unavailable substituted tricarballic acids.

177. "The possible limitation of molecular magnitude."

By Holland Crompton.

No upper limit is usually assigned to molecular magnitude. E. Fischer has synthesised a polypeptide with the molecular weight 1212, and in the case of colloids molecular weights of the order 10^4 , and even 10^5 , are commonly spoken of. A difficulty arises, however, in admitting that molecular weights can exceed a certain value, unless the density increases as the molecular weight increases.

For suppose that a compound can exist, such as a protein, with a density at 0° not much greater than that of water, and with a molecular weight of rather more than 30,000, the gram-molecule of such a compound at 0° would occupy about 30,000 c.c. The gram-molecule of a perfect gas under the standard conditions occupies only 22,400 c.c., and we should therefore have a solid compound, at 0° and under a pressure that cannot be less than one atmosphere, occupying a greater molecular volume than that of any gas.

That the molecules of liquids and solids should occupy greater volumes than those of gases under similar conditions, seems at first contrary to the usual conceptions of the gaseous, liquid, and solid states. It is true that at sufficiently low temperatures this condition must arise for all substances, but a simple calculation shows that for the majority of chemical compounds it would only occur at temperatures not far removed from the absolute zero.

Two suggestions appear to be indicated. The first is that under the ordinary conditions there is an upper limit to molecular magnitude, and that for most substances, more especially colloids, the molecular weight cannot exceed a value of about 20,000. The second is that our ordinary kineto-molecular conceptions no longer apply when for a given temperature the molecular magnitude exceeds a certain critical value. The latter view seems most in keeping with our present knowledge, and perhaps serves to throw some light on the behaviour of colloids.

178. "The products of the oxidation of chloroacenaphthene with chromic acid." By Holland Crompton and Wilhelmina Rebecca Smyth.

Chloroacenaphthene was dissolved in about ten times its weight of boiling acetic acid, and then treated with from three to five times its weight of sodium dichromate. A vigorous reaction takes place, which is complete in about fifteen minutes. Three products are always formed, namely, chloroacenaphthenequinone, dichlorodiacenaphthylidenedione, and chloronaphthalene-1:8-dicarboxylic acid. The smaller proportion of dichromate favours the production of the first two, the larger proportion that of the third product. The yields are almost theoretical. The reaction product after being well washed with water is first boiled with a 10 per cent. solution of sodium carbonate to remove the chloronaphthalene-1:8-dicarboxylic acid, and then heated with a concentrated solution of potassium hydrogen sulphite to extract the quinone. The residue after washing and drying is finally crystallised from xylene.

Chloroacenaphthenequinone, $C_{12}H_5O_2Cl$, is obtained from the potassium hydrogen sulphite solution by boiling this with sulphuric acid. It crystallises from acetic acid in yellow needles melting at 216° (corr.). The crystalline potassium hydrogen sulphite compound has the composition $C_{12}H_5O_2Cl \cdot KHSO_3 \cdot 2H_2O$. It gives a colourless *dioxime* with hydroxylamine, this compound gradually blackening on heating, but having no definite melting point. With phenylhydrazine it gives a brilliant red *monohydrazone*, melting at 174° (corr.). No dihydrazone was obtained.

Dichlorodiacenaphthylidenedione, $\text{C}_{10}\text{H}_5\text{Cl} \begin{array}{c} \diagup \text{CO} \text{ CO} \diagdown \\ | \quad | \\ \text{C} = \text{C} \end{array} \text{C}_{10}\text{H}_5\text{Cl}$,

crystallises in small, orange-red needles melting at 328° (corr.). It is very sparingly soluble in alcohol, chloroform, or acetic acid, but fairly so in boiling xylene, from which it can be crystallised. On reduction with hydriodic acid it gives chloroacenaphthene.

Chloronaphthalene-1:8-dicarboxylic acid has been already described (*Proc.*, 1908, **24**, 241), but the melting point of the anhydride is found to be higher than that previously given, and should be 213° (corr.). Salts of this acid were prepared and analysed.

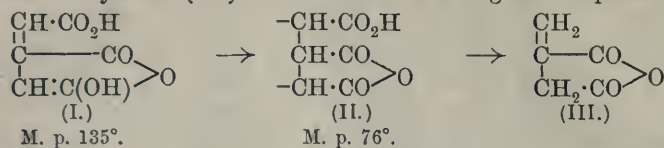
179. "The influence of colloids and fine suspensions on the solubility of gases in water. Part II. Solubility of carbon dioxide and of hydrogen." By Alexander Findlay and Bucchok Shen.

In continuation of the work of Findlay and Creighton (*Trans.*, 1910, **97**, 536), the authors have determined the solubility of carbon dioxide in solutions of ammonium chloride, potassium chloride, barium chloride, ferrous ammonium sulphate, sucrose, chloral hydrate, methyl-orange, peptone, propeptone, and hæmoglobin; and of hydrogen in solutions of dextrin, starch, gelatin, ferric hydroxide, and a suspension of metallic silver. It is found that the solubility of carbon dioxide in solutions of the salts mentioned above and in solutions of sucrose and chloral hydrate is in harmony with Henry's law, so that the behaviour found in the case of these solutions is different from that met with in the case of colloidal solutions. In the solutions of peptone, propeptone, and hæmoglobin the solubility of carbon dioxide is greater than in water, but decreases as the pressure is increased. This behaviour is explained on the basis of chemical combination. The solubility of hydrogen in solutions of dextrin, starch, gelatin, ferric hydroxide, and in a suspension of finely divided silver is, with the possible exception of the solutions of gelatin, in harmony with Henry's law.

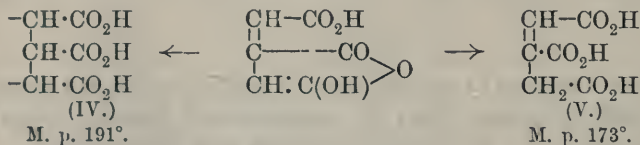
180. "The chemistry of the aconitic acids. Part I. The labile modification of aconitic acid and the hydroxy-anhydro-acid." By Norman Bland and Jocelyn Field Thorpe.

The structure of the hydroxy-anhydro-acid mentioned in a preliminary communication (this vol., p. 131) has been found to be that represented by formula (I), since it passes into the normal

anhydro-acid (II) when heated above its melting point, and yields itaconic anhydride (III) when heated at a higher temperature:



The hydroxy-anhydro-acid is converted into normal aconitic acid (IV) by hydration with water, but yields labile aconitic acid (V) when hydrated by strong alkali or by dilute alkali in the presence of casein:



Derivatives of the hydroxy-anhydro-acid and of the labile acid were described.

181. "The action of bromine on cholesteryl benzoate." (Preliminary note.) By Charles Dorée and Charles Stotesbury.

It was observed by Obermüller (*Zeitsch. physiol. Chem.*, 1891, 15, 42) that cholesteryl benzoate, when treated in the cold with a solution of bromine in carbon disulphide, did not give the expected cholesteryl benzoate dibromide, $\text{C}_{27}\text{H}_{45}\text{OBr}_2 \cdot \text{C}_7\text{H}_5\text{O}$; instead, a monobromo-substituted derivative, $\text{C}_{27}\text{H}_{44}\text{OBr} \cdot \text{C}_7\text{H}_5\text{O}$, melting at 138° was obtained. The authors, in repeating this, find that during the bromination only a very slight evolution of hydrogen bromide takes place, and that the product contains two substances which differ in solubility and crystalline form. The more soluble one crystallises from acetone in needles melting at 139° , and appears to be identical with the derivative mentioned above. The other is very characteristic, crystallising in large (frequently 1 cm. long), clear, hexagonal prisms melting at 168° . The yield of this substance is increased if chloroform is used as the solvent. Analysis agrees with the formula $\text{C}_{27}\text{H}_{45}\text{OBr}_2 \cdot \text{C}_7\text{H}_5\text{O}$, and the investigation is being continued in order to ascertain whether this compound is the hitherto unknown benzoate dibromide.

182. "A theory of fluorescence."

By Edward Charles Cyril Baly and Rudolf Krulla.

In every compound formed by virtue of primary valencies alone, the secondary valencies of the atoms are unsaturated. Every such

atom must therefore form the centre of a field of force, but the independent existence of these fields must be metastable, and they must condense together with the escape of free energy. Such condensed systems of force lines can be opened by the influence of a solvent and of light. The opening up takes place in stages, each stage absorbing definite light waves. On the basis of this conception was put forward a theory of fluorescence, and experimental evidence was given in favour of it. Certain substances were shown in one solvent to emit fluorescent light of the same wavelength as they absorb in a second solvent.

183. "Chemical reactivity and absorption spectra. Part I."

By Edward Charles Cyril Baly and Francis Owen Rice.

The authors have considered the condensed force fields which must exist around the molecules of a compound, with regard to the phenomena of fluorescence (preceding abstract). With reference to the question of their chemical reactivity, it is evident that the reactivity of these closed systems must be vanishingly small, and that no molecules can enter into any chemical reaction until these systems have been opened up. There must be, therefore, at least two stages in any chemical reaction, one in which the closed system is opened up, and the other in which the reaction proper takes place. These two stages have been observed in the sulphonation of the benzene ring by means of absorption spectra, and the absorption curves show the stages in the sulphonation of anisole, *o*- and *p*-nitroanisole, quinol dimethyl ether, and other substances.

184. "The wet oxidation of metals. Part II. The rusting of iron" (continued). By Bertram Lambert.

The work published by the author and a collaborator (*Trans.*, 1910, **97**, 2426) on the corrosion of commercial forms of iron has been criticised by Friend ("The Corrosion of Iron and Steel," p. 65), "T. M. L." (*Nature*, 1911, p. 25), and "H. E. A." (*Science Progress*, 1911, 642). It is suggested (1) that all traces of carbonic acid had probably not been removed from the apparatus used; (2) that there is a serious objection to the use of quartz vessels, since the quartz might dissolve to a sufficient extent to play the same part as is usually attributed to carbonic acid by the supporters of the acid theory of corrosion; (3) that water prepared by distillation from strong solutions of barium hydroxide probably contains traces of carbonic acid.

The experiments have been repeated with additional precautions

and refinements which have been devised to test the validity of these objections. The results of the experiments go to show that the objections have no foundation in fact, and that it may be considered as established beyond any reasonable doubt that commercial forms of iron will always undergo corrosion when exposed to the action of water and oxygen, even in the complete absence of carbonic acid or any other acid.

An electrolytic theory of the corrosion of iron, based on the differences in solution tension of different parts of the metal, was discussed.

Some further properties of pure iron were described, in particular its behaviour towards solution of copper salts. Pure iron can be exposed to the action of saturated solutions of copper sulphate or copper nitrate at the ordinary temperature without copper being deposited on the iron, but exposure to extremely dilute solutions of copper chloride will cause the immediate deposition of copper on the iron.

185. "Colouring matters of the flowers of the *Cedrela toona*."

By Arthur George Perkin.

These flowers, which constitute an Indian dyestuff of minor importance, yield a minute amount of a red, crystalline colouring matter, $C_{15}H_{18}O_3$, identical with the nycanthin obtained by Hill (*Trans.*, 1907, **91**, 1501) from the flowers of *Nycanthes arbor tristis*. This melts at $285-287^\circ$, and not $234-235^\circ$, as given by Hill, and in dyeing and other properties closely resembles, but is not identical with, the bixin of annatto (*Bixa orellana*). The presence of quercetin contaminated with a trace of an allied colouring matter as glucosides, and of a sugar, $C_{12}H_{22}O_{11}$, have also been detected, and to the former the main dyeing properties of the flowers appear to be due.

186. "The so-called manganese trioxide." (Preliminary note.)

By Frederick Russell Lankshear.

Franke's "pink gas" (*J. pr. Chem.*, 1887, [ii], **36**, 31, 166; Thorpe and Hambly, *Trans.*, 1888, **53**, 175) is conveniently prepared by allowing a 6 per cent. solution of potassium permanganate in concentrated sulphuric acid to drop into a well-cooled mixture of 1 part of sodium hydrogen carbonate with 4 parts of anhydrous sodium carbonate. The evolved gases are led into a tube cooled in liquid air, where a pink solid mass soon forms. When the carbon dioxide has volatilised from this, an amorphous solid

remains, which usually melts at about -6° . It effervesces with sodium carbonate, is free from sulphuric acid, and dissolves quietly in water to form a brownish-red solution, which, however, soon deposits manganese dioxide, leaving permanganic acid in solution.

The pink substance is also formed by the action of moist air on the invisible gas given off by the solutions of potassium permanganate in sulphuric acid. This gas has been aspirated through a tube cooled in liquid air, and found to be manganese heptoxide, Mn_2O_7 .

Determinations of the water in the "pink gas" give a mean ratio of about 15 molecules of water to 1 of manganese compound. The ratio of oxygen to manganese has been measured in two ways: by measuring the volume of oxygen and the weight of manganese dioxide (estimated as Mn_3O_4) given on heating the pink substance, and by measuring the permanganic acid and the manganese dioxide produced (Chatard's process) when the pink gas is blown into water. The former measurement gave a ratio O/MnO_2 of 1.25 to 1; the latter 1.24 to 1. There is thus more oxygen in the substance than required by the formula MnO_3 , and less than that demanded by Mn_2O_7 .

In view of the facts that much water is present, that solutions of permanganate in sulphuric acid give off manganese heptoxide which forms the "pink gas" with moist air, and that the ratio of oxygen lies nearer that required by permanganic than by manganic acid, it must be concluded that the manganese-containing constituent of Franke's "pink gas" is merely hydrated permanganic acid with varying quantities of lower oxides or hydroxides, so that the existence of the oxide MnO_3 still requires demonstration.

187. "Co-ordination compounds of vanadium." (Preliminary note.)

By Gilbert T. Morgan and Henry Webster Moss.

Anhydrous vanadium trichloride reacts with acetylacetone in the presence of some reagent for removing hydrogen chloride to give rise to two acetylacetonates.

Vanadium teracetylacetonate, $\text{V} \left[\begin{array}{c} \text{O}:\text{CMe} \\ \diagdown \quad \diagup \\ \text{O} \cdot \text{CMe} \end{array} \right]_3 \text{CH}$, is produced either by treating vanadium trichloride and acetylacetone in alcoholic solution with the calculated quantity of sodium ethoxide, or by adding aqueous sodium carbonate to a mixture of the trichloride, acetylacetone, and chloroform, when the product dissolves in the organic solvent, and crystallises therefrom in transparent, yellowish-brown plates or prisms. The compound separates from alcohol or from acetylacetone in reddish-brown prisms; it melts at $265\text{--}266^{\circ}$, and can be distilled without decomposition.

Vanadium oxybisacetylacetonate, $\text{VO} \left[\begin{array}{c} \text{O} \cdot \text{CMe} \\ \text{O} \cdot \text{CMe} \end{array} \right]_2 \text{CH}$, results from the aerial oxidation of the preceding substance; it crystallises from ether or alcohol in well-defined, hard, transparent, bluish-green plates and prisms, which decompose and char on heating. Compounds corresponding with the preceding acetylacetonates have been prepared from benzoylacetone and vanadium trichloride.

The trichloride and pyridine combine either alone or in alcoholic solution to form a very soluble co-ordination compound dissolving in alcohol to an intensely purple solution. Ethylenediamine changes the green colour of alcoholic vanadium trichloride to a deep brown; the co-ordination product is very soluble.

Methylamine, dimethylamine, triethylamine, and benzylamine produce a similar colour change to brown in the green alcoholic solution of the trichloride; the products of these interactions are under examination. Vanadium trichloride dissolves in liquid ammonia, the product being soluble in water.

Although soluble in absolute alcohol to a green solution, anhydrous vanadium chloride is insoluble in dry ether free from alcohol.

The authors proposed to continue the investigation of co-ordination compounds containing vanadium as the central element.

188. "Substituted thiolazo-derivatives of benzene."

By John Jacob Fox and Frank George Pope.

Benzeneazophenylmethylmercaptole, $\text{C}_6\text{H}_5 \cdot \text{N} : \text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{SMe}$, and *benzeneazophenylethylmercaptole* have been prepared by the action of the corresponding alkyl iodides on the potassium salts obtained by the hydrolysis of the xanthic ester derived from aminoazobenzene. These substances resemble the corresponding ethers of benzeneazophenol, and yield hydrochlorides and hydrates.

p-Nitrobenzeneazophenylmethylmercaptole was obtained in small amount by the action of *p*-nitrobenzenediazonium chloride on phenyl mercaptan in alkaline solution, and subsequent treatment of the potassium salt of *p*-nitrobenzeneazophenylmercaptan with methyl iodide.

The band in the absorption spectrum of benzeneazophenylmethylmercaptole was found to occupy an intermediate position between the bands given by benzeneazophenetole and aminoazobenzene.

EXTRA MEETING OF THE SOCIETY.

At an Extra Meeting of the Chemical Society held on Wednesday, June 26th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair, Sir WILLIAM TILDEN delivered the Cannizzaro Memorial Lecture.

A vote of thanks to Sir WILLIAM TILDEN, proposed by Sir WILLIAM RAMSAY, seconded by Sir EDWARD THORPE, was supported by the PRESIDENT, and carried with acclamation.

INTERNATIONAL ASSOCIATION OF CHEMICAL SOCIETIES.

The following announcement of the Proceedings at the meeting of the International Association of Chemical Societies, held in Berlin in April, 1912, is made by order of the Council.

EXTRACT FROM THE MINUTES OF THE SECOND MEETING OF THE COUNCIL IN BERLIN, APRIL 11TH—13TH, 1912.

The following were present:

(a) As full members of Council:

W. Ostwald, President, H. Wichelhaus, Vice-President, P. Jacobson, General Secretary, for the Deutsche Chemische Gesellschaft;

A. W. Crossley, P. F. Frankland, W. Ramsay for the Chemical Society (London);

A. Béhal, A. Haller, M. Hanriot for the Société Chimique de France;

Fr. Fichter, Ph. A. Guye, A. Werner for the Schweizerische Chemische Gesellschaft;

W. A. Noyes for the American Chemical Society;

N. S. Kurnakow, L. A. Tschugaeff, P. J. Walden for the Russian Chemical Society.

(b) As members of Council in an advisory capacity only:

Ch. Marie for the Société de Chimie-Physique, Paris; Fr. Auerbach for the Deutsche Bunsen Gesellschaft; E. Cohen for the Nederlandsche Chemische Vereeniging; H. Goldschmidt for the Polyteknisk Forenings Kemikergruppe (Christiania); E. Biilmann for the Kemisk Forening, Copenhagen.

During the course of the meeting the following members included in section (b), namely, Messrs. E. Cohen, H. Goldschmidt, and E. Biilmann, joined the Council as full members in consequence of a decision to confer upon their respective societies the right of representation on the Council.

The following Members of Council, Messrs. Carrara (*Società Chimica Italiana*), Day (*American Chemical Society*), Ogialoro (*Soc. Chim. Ital.*), Paternò (*Soc. Chim. Ital.*), and Richards (*Amer. Chem. Soc.*), notified their inability to attend the meetings.

The President of the Association, W. Ostwald, occupied the Chair.

The Chairman presented a Report on the development of the Association during the first year of its existence from April, 1911, to April, 1912. The Association, which originally consisted only of three Societies [the *Société Chimique de France*, the *Chemical Society (London)*, and the *Deutsche Chemische Gesellschaft*], had grown considerably during the year—due, in part, to the acceptance of invitations to join the Association, and in part to the granting by the Council of applications for admission—and the Association now included representatives of almost all countries in which Chemical Societies exist.

During the meeting several requests for admission into the Association or for representation on the Council were granted. The membership of the Association at the close of the meeting may be seen from the following list of constituent Societies arranged in their order of admission:

	Number of Members.
* <i>Société Chimique de France</i> (25 April, 1911) ...	1024
* <i>The Chemical Society (London)</i> (25 April, 1911) ...	3132
* <i>Deutsche Chemische Gesellschaft</i> (25 April, 1911) ...	3352
<i>Société de Chimie-Physique</i> (15 June, 1911) ...	202
<i>Deutsche Bunsen Gesellschaft für angewandte physikalische Chemie</i> (19 June, 1911) ...	719
* <i>Nederlandsche Chemische Vereeniging</i> (14 July, 1911) ...	502
* <i>Schweizerische Chemische Gesellschaft</i> (3 August, 1911) ...	287
* <i>American Chemical Society</i> (6 October, 1911) ...	5603
* <i>Russian Chemical Society</i> (22 October, 1911) ...	399
* <i>Polyteknisk Forenings Kemikergruppe (Christiania)</i> (27 October, 1911) ...	105
* <i>Verein Österreichischer Chemiker</i> (28 October, 1911) ...	972
* <i>Società Chimica Italiana</i> (11 January, 1912) ...	648
* <i>Kemisk Forening, Copenhagen</i> (23 January, 1912) ...	137
<i>Tokyo Chemical Society</i> (18 March, 1912) ...	544
* <i>Société Espagnole de Physique et de Chimie</i> (10 April, 1912) ...	?

Total about 18000

* The societies marked with an asterisk (as the representative societies of their respective countries) are each entitled to send three delegates to the Council (cf. Articles IV and V of the Statutes).

"Suggestions for the Alteration and Amplification of the Statutes" were next considered. After discussion, alterations of Articles IV, V, and XII, concerning the method of voting (*a*) on the admission of new Societies to the Association, (*b*) on alterations in the Statutes, and also a supplementary Article XIII, dealing with the case of an equality of votes, were unanimously carried.

The statutes, as at present constituted, are given in Appendix I.

The meeting next proceeded to consider the reports of the Committees on the following questions:

- (1) The Nomenclature of Inorganic Chemistry,
- (2) The Nomenclature of Organic Chemistry,
- (3) The Unification of Physical Constants.

In accordance with the decision of the Council at its first meeting in Paris on the 25th and 26th of April, 1911, the Societies represented on the Council had been requested to nominate committees for the consideration of these questions. The following Societies had accordingly each appointed three committees, all of which, eighteen in number, had presented reports:

Société Chimique de France;
 The Chemical Society (London);
 Deutsche Chemische Gesellschaft;
 Schweizerische Chemische Gesellschaft;
 American Chemical Society;
 Russian Chemical Society.

The discussion turned mainly on the methods of organisation in connexion with these questions, the consideration of the actual subject-matter being postponed until a later date. The meeting was called upon to decide as to whether the questions should continue to be dealt with by the national committees or whether the latter should be replaced by smaller international committees. The Council was of opinion that with regard to inorganic and organic nomenclature, the circumstances were different from those obtaining in the case of the unification of chemical and physical constants.

The following resolution concerning inorganic and organic chemical nomenclature was carried unanimously:

"The national committees shall continue to exist for the present. Any Societies represented on the Council which have not as yet appointed committees shall proceed to do so forthwith."

"The reports of the committees are to be submitted to a process of sifting before the next meeting of the Council. The method of sifting to be adopted is a matter for arrangement between the

officers of the Association and the committees' representatives on the Council."

In order to avoid any confusion arising out of the premature adoption and publication by authors of nomenclature suggested by their respective national committees, the following resolution was unanimously carried by the Council:

"The Council expresses the hope that the introduction of new suggestions for nomenclature in place of existing terms will be avoided as far as possible until the question of nomenclature has been formulated by the Association. Authors' suggestions regarding nomenclature should be submitted to the existing committees for their consideration."

Chemical Societies are to be requested to publish in their respective journals this resolution, which is not meant to prejudice the publication of new suggestions when the necessity arises in consequence, for example, of the discovery of new types of compounds.

The composition of the existing committees on inorganic and organic chemical nomenclature is given in Appendix II.

With regard to the third question, namely, the unification of physical chemical constants, it was pointed out, both in the reports of the committees and during the course of the discussion, that a considerable amount of work had already been done in that direction by existing organisations, for example, the Deutsche Bunsen Gesellschaft, and the authors of "Tables of Physical Chemical Constants." It was therefore generally considered that there was no further need for the existence of the various national committees appointed by the Council. Accordingly an international Commission was nominated, composed of those Members of the Council who by their activities were most directly concerned with this question, namely, Messrs. Carrara, Cohen, Day, Goldschmidt, Guye, Ostwald, Ramsay, Richards, and Walden. This Commission should, as far as possible, work in agreement with other existing organisations appointed for the same purpose.

It was next announced by the President that the members of the International Committee on Atomic Weights—Messrs. Clarke, Thorpe, Urbain, and Ostwald—had expressed a wish to become incorporated with the International Association. Prof. Ostwald was requested by the Council to ask the existing members of the International Committee on Atomic Weights to draft statutes for the future organisation of this committee, and to submit these to the Council of the Association at its next meeting.

The Council next considered proposals for the further extension of the Association's activity.

Prof. Guye, who had pointed out the desirability of a uniform

abbreviation of titles of journals, was appointed by the Council to take preliminary steps for the attainment of this object.

Prof. Ostwald brought forward arguments in favour of the unification of the size of printed scientific literature in accordance with the views expressed in his pamphlet entitled, "Die Weltformate" (Ansbach, 1911). The Council thereupon unanimously expressed the hope that all Chemical Societies would issue their publications in the "Weltformat" 16×22.6 cm. (these measurements referring to the cut copies), or in some form derived from this. The Council furthermore unanimously resolved that the publications of the Association should be issued in this form (16×22.6 cm.).

The suggestions by Prof. Ostwald concerning an international language called forth considerable discussion. The following suggestion was adopted unanimously:

"The Council should appoint a committee to investigate the question of the mitigation of the difficulties arising from the existing multiplicity of languages employed in scientific literature."

Each Society represented on the Council is to nominate a delegate on this committee, the organisation of which was entrusted to the Swiss delegate.

Finally, the Balance Sheet for the general expenses of the Association during the past year was adopted; the sum spent amounted to 1200 mk. (£60), or about 6—7 pf. (approximately $\frac{3}{4}$ d.) per member of all the constituent Societies.

The next meeting of the Council will take place in England in the middle of September, 1913. Sir William Ramsay was elected President. The officers* of the Association are consequently the delegates of the Chemical Society (London), namely:

Sir William Ramsay, London,	President.
Prof. Percy F. Frankland, Birmingham,	Vice-President.
Prof. Arthur W. Crossley, London,	General Secretary.

who remain in office until the end of the next meeting.

W. Ostwald,
President until April, 1912.

H. Wichelhaus,	P. Jacobson,
Vice-President until April, 1912.	General Secretary until April, 1912.

* All communications should be addressed to :

Prof. A. W. Crossley,
Chemical Society,
Burlington House,
London, W.

APPENDIX I.

STATUTES OF THE INTERNATIONAL ASSOCIATION OF
CHEMICAL SOCIETIES

(according to the Resolutions of April 26, 1911, and April 11, 1912).

Art. I. Il est fondé une Association Internationale des Sociétés Chimiques.

Art. II. Le but de l'Association est de former un lien entre les Sociétés chimiques du monde, pour s'occuper des questions ayant un intérêt général et international pour la Chimie.

Art. III. Toutes les Sociétés chimiques peuvent faire partie de l'Association après un vote favorable du Conseil (comp. Art. IV). Le vote par correspondance est admis dans ce cas.

Art. IV. L'Association est dirigée par un Conseil formé d'un certain nombre de membres. Chaque pays ne peut être représenté dans le Conseil que par une seule Société chimique, qui désignera trois représentants.

Art. V. Le Conseil actuel comprend les délégués des Sociétés fondatrices, c'est-à-dire de la Société chimique allemande (Deutsche Chemische Gesellschaft), de la Société chimique anglaise (Chemical Society, London,) et de la Société chimique française (Société Chimique de France).

La représentation d'une autre Société dans le Conseil ne pourra être décidée que par celui-ci, et à la majorité des deux tiers des votants.

Art. VI. Le Conseil fixe à chaque réunion le lieu et l'époque de la prochaine session.

Art. VII. Le Conseil nomme au début de chaque session un Président, qui est en même temps Président de l'Association, et qui entrera en fonctions à la fin de la session.

Art. VIII. Le Bureau est constitué par le Président, le Vice-Président et le Secrétaire Général qui sont les délégués du même pays.

Art. IX. Le Président est chargé de convoquer le Bureau. Celui-ci veille à l'exécution des décisions prises par le Conseil; il fixe l'ordre du jour des Séances du Conseil et entretient des relations entre les diverses Sociétés. Le Président fait approuver les procès-verbaux des séances. Seul, le procès-verbal de la dernière séance peut être approuvé par correspondance.

Art. X. Les moyens d'action de l'Association consistent :

En nomination de Commissions chargées d'étudier les questions qui leur seront soumises par le Conseil ;

En publication dans les journeaux des Sociétés affiliées ou en tout autre mode de publication qu'il conviendra au Conseil de choisir ;

En conférences ou Congrès.

Art. XI. Les frais généraux seront supportés par les Sociétés affiliées au prorata du nombre de leurs membres.

Toutes les dépenses autres que les frais généraux ne seront imputables aux diverses Sociétés que sous réserve d'un engagement personnel de ces Sociétés.

Le Secrétaire Général soumettra à chaque session à l'approbation du Conseil le compte-rendu financier de l'exercice écoulé.

Art. XII. Toute modification aux status exigera la présence de la moitié au moins de la totalité des membres du Conseil. Les décisions seront prises à la majorité des deux tiers des membres votants.

Art. XIII. Excepté les cas prévus par les articles V et XII, tout vote émis par le Conseil sera valable à la majorité absolue des votants.

A égalité de voix, celle du Président est prépondérante.

APPENDIX II.

COMPOSITION OF THE NATIONAL COMMITTEES ON NOMENCLATURE.

I.—*For Inorganic Chemical Nomenclature.*

Deutsche Chemische Gesellschaft :

R. Lorenz (Chairman), Kettenhofweg 136, Frankfurt a M.

K. A. Hofmann, Witzlebenstrasse 26, Charlottenburg.

A. Rosenheim, Alsenstrasse 3, Berlin NW.

Chemical Society, London :

Sir William Ramsay (Chairman), 19 Chester Terrace, Regent's Park, London, N.W.

J. C. Cain, 24 Aylestone Avenue, Brondesbury Park, London, N.W.

A. Harden, 2 Marlborough Road, Richmond (Surrey).

Société Chimique de France* :

F. Bourion (Reporter), 21 rue Vauquelin, Paris.

V. Auger, 25 rue Humboldt, Paris.

* Messrs. A. Béhal, A. Haller, and M. Hanriot, the representatives of the Société Chimique de France on the Council of the International Association, are members of all the committees appointed by the Société Chimique de France.

R. de Forcrand, Montpellier.

M. Delépine, 2 rue Alphonse-Daudet, Paris.

P. Lebeau, 4 Avenue de l'Observatoire, Paris.

E. Rengade, 10 rue Daguerre, Paris.

G. Urbain, 69 Grande-Rue, à Bourg-la-Reine (Seine), Paris.

Schweizerische Chemische Gesellschaft:

A. Werner, Freie Strasse 111, Zürich.

V. Kohlschütter, Freie Strasse 3, Bern.

American Chemical Society:

J. L. Howe (Chairman), Wash. and Lee Univ., Lexington, Va.
Philip E. Browning, Kent. Chem. Lab., Yale University, New
Haven, Ct.

E. C. Franklin, Hygienic Laboratory, Washington, D.C.

C. H. Herty, Univ. of N. C., Chapel Hill, N.C.

H. M. Patterson, Xenia, Ohio.

Owen Shinn, Dept. of Chemistry, Univ. of Penna., Phila., Pa.

A. L. Voge, Library of Congress, Washington, D.C.

Russian Chemical Society:

N. Kurnakow, Berg-Institut, St. Petersburg.

A. Gorboff, Chem. Laborat. of the Nicolai-Ingenieurakademie,
St. Petersburg.

L. Tschugaeff, Chem. Laborat. of the University, St. Petersburg.

II.—*For Organic Chemical Nomenclature.*

Deutsche Chemische Gesellschaft:

P. Jacobson (Chairman), Sigismundstr. 4, Berlin W. 10.

C. Graebe, Westendstr. 28, Frankfurt a. M.

R. Pschorr, Humboldstr. 34, Berlin-Grunewald.

R. Stelzner, Regensburger Str. 11, Berlin W. 50.

J. Thiele, Goethestr., Chem. Institut, Strassburg i. Els.

Chemical Society, London:

W. P. Wynne (Chairman), The University, Sheffield.

J. C. Cain, 24 Aylestone Avenue, Brondesbury Park, London,
N.W.

A. J. Greenaway, The Orchard, Chertsey, Surrey.

F. S. Kipping, University College, Nottingham.

Société Chimique de France*:

- L. Maquenne (Chairman), 19 rue Sufflot, Paris.
 G. Bertrand, 26 rue Dutoit, Paris.
 E.-E. Blaise, Faculté des Sciences, Paris.
 P. Freundler, 6 Place Denfert-Rochereau, Paris.
 V. Grignard, Nancy.
 R. Marquis, 10 rue Charles-Divry, Paris.
 Ch. Moureu, 17 rue Sufflot, Paris.
 M. Sommelet, 4 Avenue de l'Observatoire, Paris.
 A. Valeur, 73 Boulevard Montparnasse, Paris.

Schweizerische Chemische Gesellschaft:

- A. Pictet, Rue Bellot 13, Geneva.
 Fr. Fichter, Neubadstr. 35, Bâle.

American Chemical Society:

- M. T. Bogert (Chairman), Columbia University, New York.
 Ira Remsen, John Hopkins Univ., Baltimore, Md.
 M. Gomberg, Univ. of Mich., Ann Arbor, Mich.
 C. S. Hudson, Bureau of Chemistry, Washington, D.C.
 T. B. Johnson, Yale University, New Haven, Ct.
 J. F. Norris, Simmons College, Boston, Mass.
 W. A. Noyes, Univ. of Illinois, Urbana, Ill.
 J. B. Tingle, McMaster Univ., Toronto, Canada.

Russian Chemical Society:

- A. Faworsky, Chem. Laborat. of the University, St. Petersburg.
 N. Zelinsky, Chem. Laborat. of the University, Moscow.
 W. Ipatiew, Artillerieakademie, St. Petersburg.

 ADDITIONS TO THE LIBRARY.
I. *Donations.*

- [Field, *Frederick.*] A chemical review. By a B. pp. 25.
 London 1863. (*Reference.*) From Sir William Tilden, F.R.S.
 Neumann, *Bernhard.* Lehrbuch der chemischen Technologie und
 Metallurgie. Leipzig 1912. pp. xii + 892. ill. M. 18.—. (*Recd.*
 19/6/12.) From the Publisher: S. Hirzel.

* See footnote on p. 207.

III. *Pamphlets.*

Cross, Charles Frederick. Lectures on cellulose. pp. 52. London 1912.

Egypt, Survey Department. A report on the work of the Laboratories. By A. Lucas. pp. 26. Cairo 1912.

Gestewitz, Kurt. Beiträge zur Kenntniss der Verhaltens von Kohlenoxydblut zu gewissen fällenden Agentien. (From the *Zeitsch. exp. Path. Ther.*, 1911, 9.)

Herty, Charles H. Per cent. tables for oil in cottonseed products. With method of analysis. pp. 50. North Carolina 1908.

Hooper, David. The composition of Indian yams. (From the *J. Proc. Asiatic Soc. Bengal*, 1911, 7.)

—— Phosphorus in Indian foodstuffs. (From the *J. Proc. Asiatic Soc. Bengal*, 1911, 7.)

—— Some Asiatic milk-products. (From the *J. Proc. Asiatic Soc. Bengal*, 1911, 7.)

India. Report on the progress of agriculture in India for 1910-11. pp. 85. Calcutta 1912.

Ogilvie, James P. The determination of sucrose (cane sugar) in cane molasses by the double polarization method, using invertase and acid as hydrolysts. (From the *Int. Sugar J.*, 1912, 14.)

Patta, Aldo, and Caccia, Piero. Sul tetraioduro di para-amino-fenilarsenico. (From the *Boll. Soc. Med.-Chir. Pavia*, 1911.)

Polenske, Ed. Beiträge zum Nachweis der Benzoesäure in Nahrungs-und Genussmitteln. (From the *Arbeit. Kaiserl. Gesundheitsamte*, 1911, 38.)

Rossi, G. Su una nuova combinazione dell' exametilentetramina coll'acido ortoarsenico. (From the *Giorn. Farm. Chim.*, 1911, 60.)

Waidner, C. W., and Burgess, G. K. On the constancy of the sulphur boiling point. (From the *Bull. Bureau of Standards*, 1911, 7.)

VACATION ARRANGEMENTS.

The Rooms of the Society will be closed for redecoration throughout the month of August, during which period the annual revision of the Library will take place.

Fellows are particularly requested to return all Library Books in their possession not later than Wednesday, July 31st.

LIST OF FELLOWS, 1912.

The List of Fellows for 1912 is now in active preparation, and changes of address received after July 31st cannot be included in it.

In order that the new List may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

EIGHTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

IMPORTANT NOTICE.

It does not appear to be generally understood that members of the Congress, even if not able to attend the meetings, are nevertheless entitled to a copy of the Proceedings, which it is intended by the Executive Committee shall be issued as promptly as possible.

All chemists are therefore invited to join the Congress, whether they intend proceeding to America or not. Membership can be completed on making application, accompanied by the subscription of £1, to Dr. M. O. Forster, 84, Cornwall Gardens, London, S.W., before July 24th, after which date such communications should be made to Mr. William J. Matheson, 182, Front Street, New York City, U.S.A.

BECQUEREL MEMORIAL LECTURE.

The Becquerel Memorial Lecture will be delivered by Sir Oliver Lodge at the opening meeting of the next Session to be held on October 17th, 1912. Further details will be announced in due course.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28.

No. 405.

The Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society:

WHINFIELD,
SALCOMBE,
S. DEVON.
Sept. 16th, 1912.

GENTLEMEN,

I have the honour to forward the Annual Report of the International Committee on Atomic Weights for 1913, together with a Table of Atomic Weights, which are submitted for publication in the Society's Transactions and Proceedings, as hitherto.

The Report draws attention to all the atomic-weight determinations which have been published since the date of the preceding Report, but the only alteration suggested in the table which accompanied last year's Report is the inclusion of the element holmium, with $H_o=163\cdot5$, as the result of the work of Holmberg.

I am, Gentlemen,

Your obedient Servant,

T. E. THORPE.

*The Hon. Secretaries,
The Chemical Society,
Burlington House,
London, W.*

Annual Report of the International Committee on Atomic Weights, 1913.

SINCE the annual report for 1912 was prepared, a number of important memoirs on atomic weights have appeared. There are also one or two earlier researches which were received too late to be noticed at the proper time. These investigations may be summarised as follows:

Nitrogen.—Wourtsel (*Compt. rend.*, 1912, **154**, 115), by oxidising NO to N_2O_4 , has redetermined the ratio between nitrogen and oxygen. Five concordant measurements give, in mean, $\text{N}=14.0068$.

Potassium and Chlorine.—Staehler and Meyer (*Zeitsch. anorg. Chem.*, 1911, **71**, 368) have made careful analyses of potassium chlorate, with special precautions against contamination by the chloride. Their final series gives $\text{KCl}=74.5551$, whence $\text{K}=39.097$ and $\text{Cl}=35.458$. For a discussion of their results, see also Guye (*J. Chim. phys.*, 1912, **10**, 145), who concludes that the impurity above mentioned was, if not completely, at least sufficiently eliminated to be practically negligible.

Fluorine.—McAdam and Smith (*J. Amer. Chem. Soc.*, 1912, **34**, 592) have published two preliminary determinations of the atomic weight of fluorine. Sodium fluoride was converted into chloride by heating in dry, gaseous hydrochloric acid, and from the ratio between the weights the atomic weight was calculated. The two values found are: $\text{F}=19.0176$ and 19.0133 .

Phosphorus.—From analyses of phosphorus tribromide, Baxter, Moore, and Boylston (*Proc. Amer. Acad.*, **47**, 585; *J. Amer. Chem. Soc.*, 1912, **34**, 259) find, in mean of three series, $\text{P}=31.027$ when $\text{Ag}=107.88$. This agrees fairly well with the former work of Baxter and Jones on silver phosphate. Further work on phosphorus trichloride is promised.

Mercury.—Easley and Brann (*J. Amer. Chem. Soc.*, 1912, **34**, 137), by analyses of mercuric bromide, find $\text{Hg}=200.64$. This confirms the previous work of Easley on the chloride.

Selenium.—Kuzma and Krehlik (*Trans. Bohemian Acad. of Emperor Francis Joseph*, 19, No. 13, 1910. Data furnished to the committee by Professor B. Brauner) have redetermined the atomic weight of selenium by reduction of SeO_2 with SO_2 . The mean of ten determinations is $\text{Se}=79.26$.

Tellurium.—Harcourt and Baker (*Trans.*, 1911, **99**, 1311) have thrown doubt upon the work of Flint, who claimed to have split up the supposed element into two fractions of different atomic weight. They repeated his method of fractionation, and from the fourth fraction, found $\text{Te}=127.54$. This agrees with the figure

found by Baker and Bennett in 1907. Similar fractionations have been carried out also by Pellini (*Atti R. Accad. Lincei*, 1912, [v], 21, i, 218), who likewise failed to find any indication of a tellurium of low atomic weight.

Radium.—Hönigschmid (*Monatsh.*, 1912, 33, 253), by careful analyses of relatively large quantities of radium chloride, finds $Ra=225.95$. On the other hand, Whytlaw-Gray and Ramsay (*Proc. Roy. Soc.*, 1912, 86, A, 270), using very small quantities of material, and converting the bromide into the chloride, find $Ra=226.36$, in agreement with previous work by Madame Curie and Thorpe. Until the discordance between Hönigschmid's low value and the higher is explained, it is undesirable to change the figure given in the table.

Tantalum.—The determinations of this atomic weight by Chapin and Smith (*J. Amer. Chem. Soc.*, 1911, 33, 1497) were made by the hydrolysis of $TaBr_5$. The mean of eight determinations gave $Ta=181.80$, a figure somewhat higher than that found by Balke from similar analyses of the pentachloride.

Iridium.—Hoyer mann (*Sitzungsber. phys. med. Soz. Erlangen*, 42, 278), by five reductions of $(NH_4)_2IrCl_6$ in hydrogen, finds $Ir=192.613$.

Holmium.—Six determinations of the atomic weight of holmium by Holmberg (*Zeitsch. anorg. Chem.*, 1911, 71, 226), gave $Ho=163.45$. The well known sulphate method was employed.

There are also approximate determinations of the atomic weights of lead, zinc, and copper by Pecheux (*Compt. rend.* 1912, 154, 1419), and of calcium by Oechsner de Coninck (*Compt. rend.*, 1911, 153, 1579). The figures obtained are not conclusive enough to justify their use in the table, for the methods employed were not of great accuracy.

Only one change is recommended in the table for 1913, namely, the insertion of holmium, for which, hitherto, no good atomic-weight determination has been available. Two or three other alterations of small importance might be made, but it seems undesirable to make changes too frequently.

(Signed)

F. W. CLARKE.
T. E. THORPE.
W. OSTWALD.
G. URBAIN.

1913.

International Atomic Weights.

O=16.			O=16.		
Aluminium	Al	27.1	Molybdenum	Mo	96.0
Antimony.....	Sb	120.2	Neodymium.....	Nd	144.3
Argon	A	39.83	Neon.....	Ne	20.2
Arsenic	As	74.96	Nickel	Ni	58.68
Barium.....	Ba	137.37	Niton (radium emanation) Nt	222.4	
Bismuth	Bi	208.0	Nitrogen	N	14.01
Boron	B	11.0	Osmium	Os	190.9
Bromine	Br	79.92	Oxygen.....	O	16.00
Cadmium.....	Cd	112.40	Palladium.....	Pd	106.7
Cæsium.....	Cs	132.81	Phosphorus	P	31.04
Calcium	Ca	40.07	Platinum.....	Pt	195.2
Carbon	C	12.00	Potassium.....	K	39.10
Cerium.....	Ce	140.25	Praseodymium.....	Pr	140.6
Chlorine	Cl	35.46	Radium.....	Ra	226.4
Chromium	Cr	52.0	Rhodium	Rh	102.9
Cobalt	Co	58.97	Rubidium.....	Rb	85.45
Columbium	Cb	93.5	Ruthenium	Ru	101.7
Copper	Cu	63.57	Samarium	Sa	150.4
Dysprosium.....	Dy	162.5	Scandium.....	Sc	44.1
Erbium	Er	167.7	Selenium	Se	79.2
Europium.....	Eu	152.0	Silicon	Si	28.3
Fluorine	F	19.0	Silver	Ag	107.88
Gadolinium	Gd	157.3	Sodium.....	Na	23.00
Gallium	Ga	69.9	Strontium	Sr	87.63
Germanium	Ge	72.5	Sulphur	S	32.07
Glucinum.....	Gl	9.1	Tantalum	Ta	181.5
Gold	Au	197.2	Tellurium	Te	127.5
Helium.....	He	3.99	Terbium.....	Tb	159.2
Holmium.....	Ho	163.5	Thallium	Tl	204.0
Hydrogen.....	H	1.008	Thorium	Th	232.4
Indium	In	114.8	Thulium	Tm	168.5
Iodine	I	126.92	Tin	Sn	119.0
Iridium.....	Ir	193.1	Titanium	Ti	48.1
Iron	Fe	55.84	Tungsten	W	184.0
Krypton	Kr	82.92	Uranium	U	238.5
Lanthanum	La	139.0	Vanadium	V	51.0
Lead	Pb	207.10	Xenon	Xe	130.2
Lithium	Li	6.94	Ytterbium (Neoytterbium) Yb	172.0	
Lutecium	Lu	174.0	Yttrium	Yt	89.0
Magnesium	Mg	24.32	Zinc	Zn	65.37
Manganese	Mn	54.93	Zirconium.....	Zr	90.6
Mercury	Hg	200.6			

The following are abstracts of papers received during the vacation, and published, or passed for publication, in the *Transactions*:

189. "The essential oil of the leaves of *Atherosperma moschatum* ('Australian sassafras')." By Margaret Emilie Scott. (Trans., 1912, 1612.)

The essential oil of *Atherosperma moschatum*, Labill., contains the following compounds in approximately the proportions indicated: eugenol methyl ether, 50—60 per cent.; pinene, 15—20 per cent.; camphor, 15—20 per cent.; and safrole, 5—10 per cent.

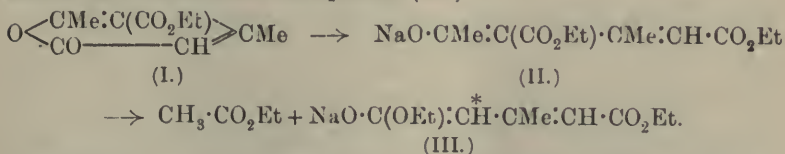
190. "Harmine and harmaline. Part I." By William Henry Perkin, jun., and Robert Robinson (Trans., 1912, 1775.)

A detailed description of work of which a preliminary account has already appeared (this vol., p. 153).

191. "The chemistry of the glutaconic acids. Part V. The preparation of esters of the labile acids." By Norman Bland and Jocelyn Field Thorpe. (Trans., 1912, 1557.)

The esters of those labile acids of the series which, by reason of the presence of a methyl group on the central carbon atom of the three-carbon system, possess considerable stability, can be prepared by the dissociation of their sodium compounds, provided that such a compound contains a potentially mobile hydrogen atom within its molecule.

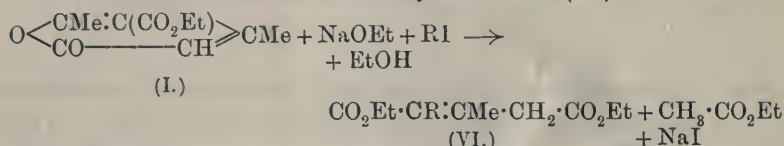
Thus the action of sodium ethoxide on ethyl isodehydracetate (I) yields the sodium compound (II), and, by further action, ethyl acetate and the sodium compound (III):



This sodium compound contains a potentially mobile hydrogen atom (*); it therefore reacts with water, yielding the pure labile ester (IV). The corresponding normal ester (V) can be prepared by the esterification of the normal acid:



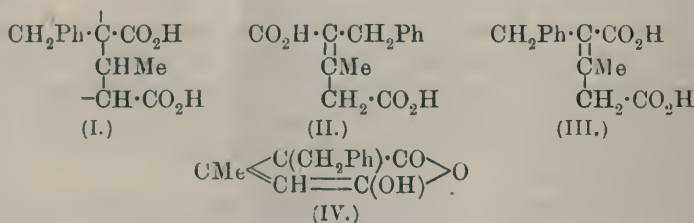
The alkylation of the sodium compound (II) leads to the formation of the labile esters of the dialkylated acids (VI):



and by this means the labile forms of both $\alpha\beta$ -dimethylglutaconic acid and of β -methyl- α -ethylglutaconic acid can be isolated.

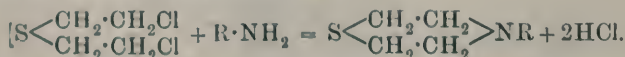
192. "The chemistry of the glutaconic acids. Part VI. Conditions which confer stability on the *trans*-forms of the labile acids." By Norman Bland and Jocelyn Field Thorpe. (Trans., 1912, 1739.)

By increasing the weight of groups attached to the carbon atoms of the three-carbon system, sufficient stability is conferred on the labile state to render it capable of isolation in its *cis*- and *trans*-modifications; thus α -benzyl- β -methylglutaconic acid has been obtained as the normal form (I) melting at 148° , the *trans*-modification of the labile form (II) melting at 134° , and the unstable *cis*-modification of the labile form (III) which passes into the hydroxy-anhydride (IV) melting at 69° , when liberated from its salts:



193. "4-Alkyl-1:4-thiazans." By Hans Thacher Clarke. (Trans., 1912, 1583.)

Alkyl derivatives of the cyclic compound thiazan, or thiomorpholine, $\text{S} \begin{array}{c} \text{C}_2\text{H}_4 \\ \text{C}_2\text{H}_4 \end{array} \text{NH}$, in which the alkyl group is attached to the nitrogen atom, may be prepared by the interaction of $\beta\beta'$ -dichloroethyl sulphide and primary amines:



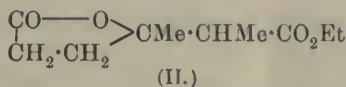
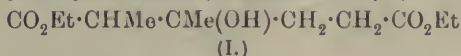
The *methyl*-, *ethyl*-, *isoamyl*-, and *benzyl*-thiazans, together with characteristic derivatives, are described.

194. "The triazo-group. Part XXI. Benzenoid azoimides containing multivalent iodine." By Martin Onslow Forster and Johannes Heinrich Schaeppi. (Trans., 1912, 1359.)

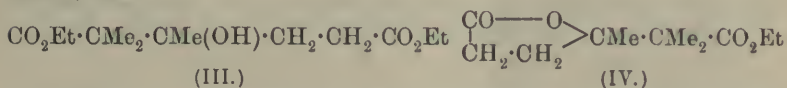
In order to ascertain whether any intramolecular action occurs between the azoimide nucleus and the iodoso- or iodoxy-group, the three iodophenylazoimides were prepared and converted into their respective triazophenyl iodochlorides, triazo-iodosobenzenes, triazo-iodoxybenzenes, and di-triazophenylidinium iodides.

195. " β -Hydroxy- $\alpha\beta$ -dimethyladipic acid and β -hydroxy- $\alpha\alpha\beta$ -trimethyladipic acid." By Victor John Harding. (Trans., 1912, 1590.)

When ethyl lævulate is condensed with ethyl α -bromopropionate by means of zinc in benzene solution, there is formed a mixture of diethyl β -hydroxy- $\alpha\beta$ -dimethyladipate (I) and the ethyl ester of the lactone of β -hydroxy- $\alpha\beta$ -dimethyladipic acid (II):



A similar mixture of hydroxy-ester (III) and lactone (IV) is obtained by the condensation of ethyl lævulate and ethyl α -bromoisobutyrate:

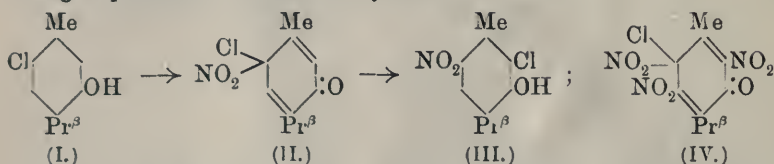


Acid hydrolysis results in the production of the lactonic acids. Attempts to prepare the unsaturated acids from the hydroxy-acids were without success.

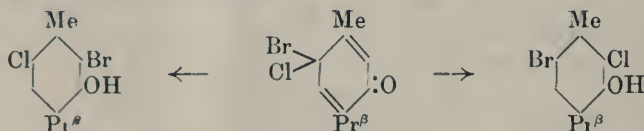
196. "The migration of the para-halogen atom in phenols." By Philip Wilfred Robertson and Henry Vincent Aird Briscoe. (Trans., 1912, 1964.)

The observation that 6-bromothymol on nitration forms 2-bromo-6-nitrothymol (Robertson, *Trans.*, 1908, **93**, 793) has led the authors to investigate in more detail the cause of the migration of the halogen atom, and to extend the observations to other compounds. A similar migration takes place with 6-chlorothymol (I) on nitration. It seemed probable that an intermediate hemiquinonoid compound (II) is first formed, and actually the dinitro-derivative

of this substance (IV) has been isolated by the action of excess of nitrogen peroxide on 6-chlorothymol:



Not only is the nitro-group capable of causing a para-halogen atom to wander into the ortho-position, but also one halogen can cause another partly to migrate in the same manner, so that when 6-chlorothymol is brominated or 6-bromothymol is chlorinated a mixture of isomeric chlorobromothymols is obtained. These observations are easily explainable on the assumption of the intermediate formation of a hemiquinonoid compound, which yields two products, as indicated below:



Similar changes have been observed in the case of certain derivatives of 2:2'-diphenol; thus, 5:5'-dichloro-2:2'-diphenol and 5:5'-dibromo-2:2'-diphenol both yield on nitration compounds containing the halogen in the 3:3'-position.

197. "The resolution of *sec.*-butylamine into optically active components." By William Jackson Pope and Charles Stanley Gibson. (Trans., 1912, 1702.)

Externally compensated *sec.*-butylamine is readily resolved into its optically active components by crystallisation with *d*- and *l*- α -bromocamphor- π -sulphonic acids; a number of derivatives of the active bases have been prepared and characterised.

198. "The relation between residual affinity and chemical constitution. Part III. Some heterocyclic compounds." By Hans Thacher Clarke. (Trans., 1912, 1788.)

A series of compounds of the general formula $X \begin{smallmatrix} < \text{CH}_2 : \text{CH}_2 > \\ \text{CH}_2 : \text{CH}_2 \end{smallmatrix} Y$, where X and Y are oxygen, nitrogen, or sulphur, has been examined. From a consideration of their chemical behaviour it is found that:

(1) the atoms X and Y exert a mutual influence, which affects their reactive power;

(2) when X and Y are atoms of the same element, the reactive power is abnormally great;

(3) when X and Y are atoms of different elements, the reactivity is abnormally small.

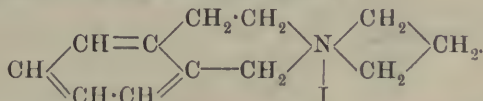
The refractive and dispersive powers, and the molecular volumes, of these and other compounds are recorded, but no definite conclusions could be drawn therefrom.

199. "The configuration of substituted ammonium compounds."

By Humphrey Owen Jones and John Gunning Moore Dunlop.

(Trans., 1912, 1748.)

The paper describes the preparation and attempted resolution of a dicyclic quaternary ammonium compound, namely, *2-trimethylenetetrahydroisoquinolinium iodide*,



On the "pyramid" configuration for quinquevalent nitrogen compounds this substance should exist in enantiomorphous forms, but no evidence that it can exhibit optical activity was obtained.

It is also to be expected that α - and β -substituted pyridinium compounds and also quinolinium compounds would exhibit optical activity. A number of compounds belonging to these classes has been examined previously (Trans., 1903, **83**, 1415; 1907, **91**, 117), and more recently Miss M. B. Thomas has examined others, but no evidence of resolution has been obtained. It would therefore appear desirable to suggest some hypothesis to account for the apparent non-existence of enantiomorphous forms in these cases.

It is suggested tentatively that a quaternary ammonium compound may be regarded as having the four alkyl groups arranged around a central nitrogen atom forming a group (Na_4), which possesses enough residual valency to unite with an electronegative radicle, forming a salt, Na_4X .

200. "Hydrolysis of acetic anhydride." By Kennedy Joseph Previté Orton and Marian Jones. (Trans., 1912, 1708.)

The hydrolysis of acetic anhydride in various media, acetic acids of various concentrations, and aqueous acetone, has been investigated by the aid of the method of determining acetic anhydride previously described (Edwards and Orton, *Proc.*, 1911, **27**, 121). The results show that the hydrolysis of acetic anhydride is quite

analogous to its reactions with hydroxy- and amino-compounds, and to the hydrolysis of esters, amides, etc.

In anhydrous media, acids are very powerful catalysts of the hydrolysis, but in water they have but a feeble influence. In aqueous solutions, alkalis and alkaline salts are most effective. Nitric acid behaves exceptionally; in a medium containing 50 per cent. acetic acid or less, it has the normal catalytic effect. As the proportion of acetic acid is increased, its apparent activity decreases until in glacial acetic acid it is infinitesimal.

201. "Acetic anhydride. The pure material, its physical properties, and its reaction with bromine." By Kennedy Joseph Previté Orton and Marian Jones. (Trans., 1912, 1720.)

The complete separation of acetic anhydride from acetic acid can be effected by fractional distillation with a Young's "pear" still-head. The boiling point of the pure anhydride is $139.55^{\circ}/760$ mm., the specific gravity 1.0876 at $15^{\circ}/4^{\circ}$, and 1.0820 at $20^{\circ}/4^{\circ}$, and the refractive index for the line H^C 1.39311 at 9.5° and 1.39069 at 15° .

Landolt (*Ann. Phys. Chem.*, 1864, [ii], **122**, 556) is the only observer whose values for these constants are in close agreement with the authors'; the most delicate analysis of acetic anhydride, containing acetic acid, is given by the method of Orton and Edwards (*Trans.*, 1911, **99**, 1181).

Pure acetic anhydride is stable to bromine and chlorine in the dark, but rapid action occurs in the presence of traces of strong acids, ferric chloride, or iodine; aluminium chloride and other ferric salts are without effect. It is remarkable that the disappearance of the bromine is independent of the initial concentration, and directly proportional to the time and to the concentration of the catalyst. Addition of small quantities of water diminishes the activity of the catalyst except in the case of iodine.

202. "The action of sulphur on amines. Part I. *o*-Toluidine." By Herbert Henry Hodgson. (Trans., 1912, 1693.)

When *o*-toluidine is treated with sulphur in the presence of *o*-toluidine hydrochloride or free hydrochloric acid, the product appears to be entirely *trithio-o-toluidine*, which may be readily isolated by means of its sparingly soluble *hydrochloride*. The *sulphate*, *oxalate*, *acetyl*, and *benzoyl* derivatives have been prepared, and also the *m*-nitrobenzylidene and *bisazo- β -naphthol* derivatives.

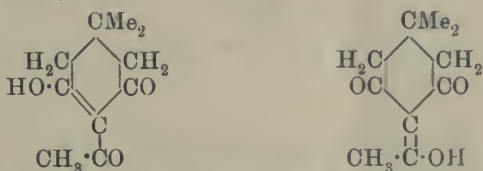
On reduction of the hydrochloride with zinc and hydrochloric acid, a mercaptan is produced which on oxidation furnishes *dithio-o-toluidine*, of which the *hydrochloride*, *sulphate*, *oxalate*, and *acetyl*, *m-nitrobenzylidene*, and *bisazo-β-naphthol* derivatives were prepared.

The bisazo-dyestuffs produced from trithio-*o*-toluidine are of remarkable fastness towards ordinary agents, particularly towards soap and alkalis.

203. "Acyl derivatives of the dihydroresorcins. Part I. The action of hydroxylamine and of phenylhydrazine on *C*-acetyl-dimethyl- and *C*-acetyltrimethyl-dihydroresorcins." By Arthur William Crossley and Nora Renouf. (Trans., 1912, 1524.)

The behaviour of *C*-acetyldimethyl- and *C*-acetyltrimethyl-dihydroresorcin towards hydroxylamine and phenylhydrazine has been investigated with the object of gaining more definite information as to the constitution of these substances.

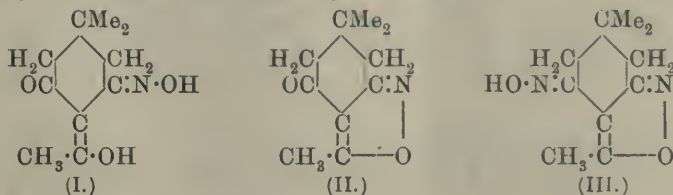
C-Acetyldimethyldihydroresorcin behaves as a monobasic acid, and may be represented by one or other of the following formulæ, probably the latter :



When acted on by hydroxylamine it gives an acid oxime (I), an *isooxazole* (II), and an oxime of the *isooxazole* (III), and with phenylhydrazine it behaves in a similar manner, giving an acid phenylhydrazone, a phenylpyrazole, and a phenylhydrazone of the phenylpyrazole.

C-Acetyltrimethyldihydroresorcin also gives an acid phenylhydrazone and a phenylpyrazole with phenylhydrazine, although all attempts to prepare a phenylhydrazone of the phenylpyrazole have so far failed.

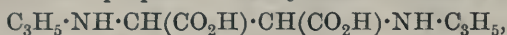
Reasons are given in the paper for assuming that these two *C*-acetyl derivatives are similarly constituted:



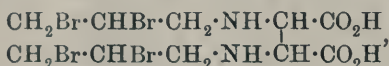
204. "The influence of solvents on the rotation of optically active compounds. Part XVIII. The effect of inorganic salts on the rotation of ethyl tartrate in aqueous solution and in the homogeneous condition." By Thomas Stewart Patterson and Duncan Geddes Anderson. (Trans., 1912, 1833.)

205. "The action of aliphatic amines on *s*-dibromosuccinic acid. Part. II. Allylamine." By Edward Percy Frankland and Henry Edgar Smith. (Trans., 1912, 1724.)

The authors have prepared a *diallylaminosuccinic acid*,



with properties similar to those of the dipropylamino- and dibutylamino-succinic acids previously obtained (*Trans.*, 1912, 101, 57), and have prepared from it a *monohydrochloride*, and *mononitroso*- and *tetrabromo*-derivatives. The latter substance:



undergoes decomposition when heated with acids, water, or alcohol, $\alpha\beta$ -dibromopropylamine or its salts being liberated, and one molecule of carbon dioxide evolved.

The authors propose to apply this reaction to other brominated alkylamino-compounds.

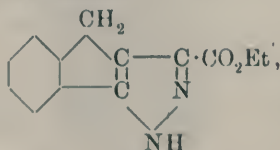
206. "Studies on cyclic ketones. Part I."

By Siegfried Ruhemann. (Trans., 1912, 1729.)

In connexion with the work on triketohydrindene hydrate and its methylenedioxy-derivative, the cyclic ketones have been subjected to a closer study with the object of transforming them into polycyclic systems. The action of ethyl oxalate on a number of cyclic ketones was examined, and ethyl α -hydrindoneoxalate,

$\text{C}_6\text{H}_4\langle\begin{smallmatrix} \text{CH}_2 \\ \text{CO} \end{smallmatrix}\rangle\text{CH}\cdot\text{CO}\cdot\text{CO}_2\text{Et}$, which is produced by this reaction,

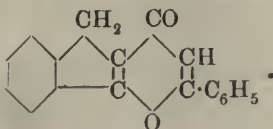
was condensed with hydrazine and phenylhydrazine to *ethyl 4:5-indenopyrazole-3-carboxylate*,



and its 1-phenyl derivative.

It was further found that α -hydrindone reacts with ethyl phenyl-

propiolate in the presence of sodium ethoxide, like acetone or acetophenone, and yields 6-phenyl-2:3-indeno-4-pyrone,



Attempts were also made to condense 1:3-dimethyl- Δ^3 -cyclohexen-5-one with *p*-nitrosodimethylaniline, with the result that an azomethine is not formed, but the nitroso-compound is reduced to tetramethyldiaminoazoxybenzene, whereas the ketone is probably oxidised to *m*-5-xenol. This view is supported by the formation of ethyl Δ^1 -cyclohexene-3:6-dione-2:5-dicarboxylate on treatment of ethyl succinosuccinate with sodium carbonate and nitrosodimethylaniline.

207. "The bromination of phenol. 2:4- and 2:6-Dibromophenol."
By Frank George Pope and Arthur Samuel Wood. (Trans., 1912, 1823.)

2:4-Dibromophenol is most rapidly prepared by the bromination of phenol in the presence of hydrobromic acid (D 1.49). The purified product melts at 40°, and has been characterised by conversion into its acetyl, benzoyl, and *p*-nitrobenzoyl derivatives and its methyl and ethyl ethers.

2:6-Dibromophenol can be obtained in good yields by the elimination of carbon dioxide from 3:5-dibromo-4-hydroxybenzoic acid. The acid may be obtained in about 90 per cent. yield by bromination of *p*-hydroxybenzoic acid in presence of sulphuric acid, and the carbon dioxide eliminated from the carboxyl group by heating the acid under pressure with dilute sulphuric acid, water, or bases. The authors are of the opinion that the reaction is ionic, since the rate of elimination of carbon dioxide is slower the greater the concentration of the mineral acid, and more rapid in the presence of bases. The resulting phenol was characterised by conversion into its nitro-derivative and into its methyl and ethyl ethers.

208. "The action of halogens on silver salts and on potassium cyanate in presence of water, with a note on the decomposition of cyanic acid in aqueous solution." By Charles William Blyth Normand and Alexander Charles Cumming. (Trans., 1912, 1852.)

The halogens react with silver salts to yield a silver halide, an acid, and one or more oxidation products of either the acid or the

halide. The reactions, on account of secondary oxidations, are sometimes complex; for example, silver thiocyanate and iodine interact according to the equation:



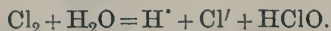
The oxidation reactions are much more marked with chlorine and bromine than with iodine.

The main product obtained by treatment of silver cyanate with iodine is carbamide, formed probably by secondary decomposition of cyanic acid. Bromine and silver cyanate yield ammonium bromide, carbamide, cyanuric acid, and a little nitrogen.

For comparison, the action of bromine on potassium cyanate was studied, and found to be in accord with the equation:



It is suggested that the reactions are due to interactions between the silver salts and the products of the hydrolysis of the halogen by water; thus, a silver salt reacts with the chloridions formed by partial hydrolysis of chlorine:



Further interaction may occur between the hypochlorous acid and one of the reaction products. The experimental results are in accord with this hypothesis.

In connexion with the formation of carbamide, some experiments on the decomposition of aqueous cyanic acid were tried, and these in conjunction with previous work led to the conclusion that cyanic acid decomposes in three different ways according to the conditions of experiment.

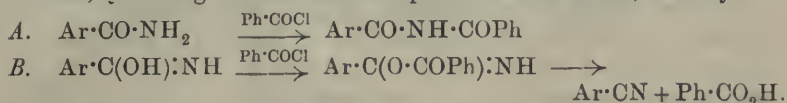
209. "The refraction and dispersion of triazo-compounds. Part II." By James Charles Philip. (Trans., 1912, 1866.)

From the results of the earlier investigation (*Trans.*, 1908, **93**, 918) and the data recorded in the present paper, the figure 8.91 is deduced as the most probable refraction value (*D*-line) for the N_3 -group in ordinary positions. The corresponding dispersion value ($H_\gamma - H_a$) is 0.348. In the case of *o*-triaziodobenzene and $\alpha\gamma$ -bis-triazopropylene, two compounds in which the N_3 -group is attached to a doubly-linked carbon atom, there is distinct enhancement of the optical values. This observation is in harmony with what was found in the earlier work.

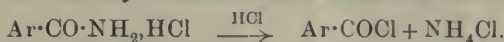
An incidental refractometric investigation of the *o*-dihalogen derivatives of benzene shows the superiority of Eisenlohr's newer values for atomic refraction as compared with the older figures for these constants.

210. "The action of acyl chlorides on primary amides." By Arthur Walsh Titherley and Thomas Halstead Holden. (Trans., 1912, 1871.)

Whilst by long heating acetyl chloride acetylates benzamide, benzoyl chloride only gives very small yields of dibenzamide (decreasing with rising temperature) and large quantities of benzonitrile and benzoic acid at 140°. The action of benzoyl chloride on *p*-toluamide was studied in order to elucidate the mechanism of the reaction, which has been shown to follow two courses, involving the normal and pseudo-amide forms, namely:



In addition to the above products, benzonitrile is also formed in quantities which are relatively great when equimolecular proportions of *p*-toluamide and benzoyl chloride are taken, but small when an excess of amide is used. Its production has been traced to the decomposition of the secondary amide under the catalytic influence of hydrogen chloride, yielding a mixture of acids and a mixture of nitriles. This action is prevented by fixation of the hydrogen chloride when an excess of amide is used owing to the formation of amide hydrochloride. An important further secondary reaction is that between the amide hydrochloride and hydrogen chloride, yielding at 140° an acyl chloride and ammonium chloride, thus:

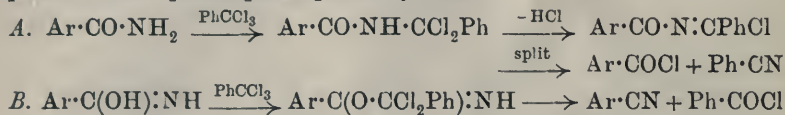


In the reaction between benzoyl chloride and *p*-toluamide, therefore, *p*-toluamide hydrochloride, ammonium chloride, *p*-toluoyl chloride, benzoic and *p*-toluic acids, benzonitrile, *p*-toluonitrile, and benzo-*p*-toluamide (and probably di-*p*-toluamide) are formed.

211. "The action of benzotrichloride on primary amides." By Arthur Walsh Titherley and Thomas Halstead Holden. (Trans., 1912, 1881.)

Salicylamide on heating with benzotrichloride readily condenses, yielding *o*-benzoyloxybenzonitrile (75 per cent. of theory), together with small quantities of *N*-benzoylsalicylamide. The mechanism of this change has been elucidated by the study of the action of benzotrichloride on acetamide, benzamide, and *p*-toluamide. The first product of the change is the nitrile and benzoyl chloride, which in the latter cases enters into further action on the amide, yielding a secondary amide and benzoic acid, as shown by the authors (preceding abstract). Since with *p*-toluamide, benzo-

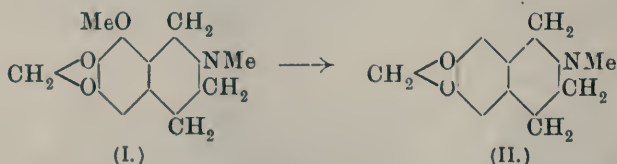
trichloride may under certain conditions yield benzonitrile along with *p*-toluonitrile (which is the main constituent when an excess of *p*-toluamide is used), as well as *p*-toluoyl chloride, two distinct condensation reactions appear to be involved when benzo-trichloride acts on an aromatic amide, in which the normal and pseudo-forms participate, probably thus:



The first reaction is favoured by the presence of hydrogen chloride on account of the formation of the amide hydrochloride, $\text{Ar}\cdot\text{CO}\cdot\text{NH}_2\cdot\text{HCl}$, which tends to react as in *A*, whilst the free amide tends to react as in *B*; and hence this reaction is favoured by an excess of *p*-toluamide. When three molecular proportions of the latter and one of benzo-trichloride react at 140° , the chief products are *p*-toluamide hydrochloride, benzo-*p*-toluamide, *p*-toluonitrile, *p*-toluic acid, and benzoic acid. When equimolecular proportions are employed, the chief products are *p*-toluoyl chloride, benzoyl chloride, *p*-toluonitrile, and benzonitrile.

212. "isoQuinoline derivatives. Part VII. The preparation of hydrastinine from cotarnine." By Frank Lee Pyman and Frederic George Percy Remfry. (Trans., 1912, 1595.)

Hydrocotarnine (I) is converted into hydrohydrastinine (II) in a yield amounting to about 40 per cent. of the theoretical by the action of sodium and alcohol:



Since hydrocotarnine is readily obtained by the reduction of cotarnine, and, on the other hand, hydrohydrastinine yields hydrastinine on oxidation, the latter alkaloid can now be prepared from cotarnine. Besides hydrohydrastinine, the following bases have been isolated from the products of the action of sodium and alcohol on hydrocotarnine: 6-hydroxy-2-methyltetrahydroisoquinoline, 7-hydroxy-2-methyltetrahydroisoquinoline, 6-hydroxy-8-methoxy-2-methyltetrahydroisoquinoline, and 7-hydroxy-8-methoxy-2-methyltetrahydroisoquinoline.

213. "The rate of reaction of alkyl haloids with certain tertiary bases." By Richard William Dades Preston and Humphrey Owen Jones. (Trans., 1912, 1930.)

The authors have studied the rate of combination of certain organic haloids (methyl, ethyl, *n*-propyl, and allyl iodides, *o*-, *m*-, and *p*-xylyl bromides, and *p*-bromobenzyl bromide) with two tertiary amines (dimethylaniline and triisobutylamine) in absolute alcohol solution at 40° and in two cases at 25°.

The results show that the ratio of the velocity-constants for the haloids is (with one exception) practically independent of the nature of the tertiary amine, and that the relative reactivities of the xylyl bromides are in the order which would be expected from a consideration of the distribution of affinity in the molecule after the manner adopted by Flürschein.

The rate of the reaction was measured by precipitating and weighing silver haloid. It has also been shown that change of conductivity of the solution can be used to measure the rate of the reaction.

214. "Derivatives of *o*-hydroxyazobenzene." By John Theodore Hewitt and William Henry Ratcliffe. (Trans., 1912, 1765.)

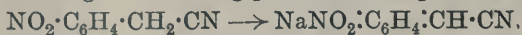
The authors have combined various substituted benzenediazonium salts with *p*-acetylaminophenol. During the progress of the work, Voroschtsoff (*J. Russ. Phys. Chem. Soc.*, 1911, **43**, 787) described *m*-acetylaminophenol-*o*-hydroxyazobenzene (m. p. 226°) and its conversion into *o*-hydroxyazobenzene; his results are fully confirmed. In the following table the bases diazotised are given in the first column, the melting points of the azo-compounds produced on combining with *p*-acetylaminophenol in the second:

<i>o</i> -Chloroaniline	..... 199—200°	<i>p</i> -Bromoaniline	..... 222—223°
<i>m</i> -Chloroaniline	..... 206—207	<i>o</i> -Nitroaniline	..... 216—217
<i>p</i> -Chloroaniline	..... 217—218	<i>m</i> -Nitroaniline	..... 231—233
<i>o</i> -Bromoaniline	..... 206—208·5	<i>p</i> -Nitroaniline	..... 235
<i>m</i> -Bromoaniline	..... 217—218		

p-Benzoylaminophenol was found to melt at 216—217°, benzoylaminophenyl benzoate at 235°, these figures substantially agreeing with those given by Reverdin. The former compound gives benzeneazo- and *p*-nitrobenzeneazo-compounds, which melt at 201° and 267—268° respectively.

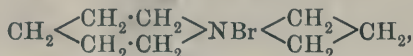
215. "The absorption spectra of nitro-compounds." By John Theodore Hewitt, Frank George Pope, and Winifred Isabel Willett (Trans., 1912, 1770.)

The authors compare the absorption of benzoic acid and its *p*-bromo- and *p*-nitro-derivatives with their sodium salts. In each case salt-formation is accompanied by only slight diminution of the oscillation frequency, and the same holds good for phenylacetic acid and its nitrile. In all these cases the possibility of quinonoid change is precluded, but when alkali is added to *p*-nitrophenyl-acetonitrile a deep purple colour is produced and a radical change in absorption spectrum occurs. Similar, although less marked, changes are observed in the case of ethyl *p*-nitrophenylacetate and *p*-nitrophenylacetic acid. Attention is drawn to the possibility of quinonoid rearrangement taking place according to the scheme:

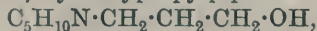


216. "A study of some dicyclic quaternary ammonium compounds." By John Gunning Moore Dunlop. (Trans., 1912, 1998.)

1:1-Trimethylenepiperidinium hydroxide, obtained by the action of silver oxide on 1:1-trimethylenepiperidinium bromide,



yields on distillation γ -hydroxypropylpiperidine,

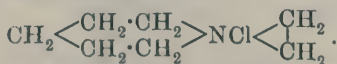


together with traces of piperidine.

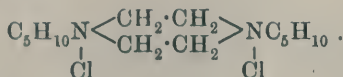
Marckwald and Frobenius (*Ber.*, 1902, **34**, 3557) stated that the product of the action of heat on β -chloroethylpiperidine,



is 1:1-ethylenepiperidinium chloride,



This is shown to be incorrect, the product being really diethylene-piperidine dichloride,

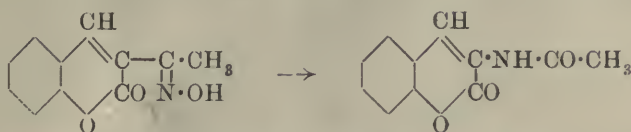


217. "3-Aminocoumarin."

By Frank William Linch. (Trans. 1912, 1578.)

3-Acetylaminocoumarin was prepared by the condensation of salicylaldehyde with glycine, or more advantageously from the

oxime of 3-acetylcoumarin by means of the Beckmann transformation: .



It crystallises in white, silky needles, melting at 201° , and on hydrolysis gives 3-aminocoumarin, which forms cream-coloured needles melting at 130° . This compound behaves as if it possessed the imino-structure; for example, nitrous acid gives an isonitroso-compound, and on hydrolysis 3-ketocoumarin is produced, with the liberation of ammonia.

7-Bromo-3-acetylcoumarin, prepared by the condensation of 5-bromosalicylaldehyde with ethyl acetoacetate, forms pale yellow needles melting at 217° ; the oxime decomposes at 220° .

7-Bromo-3-acetylaminocoumarin, prepared from the above oxime by means of the Beckmann reaction, crystallises from most organic solvents in needles melting at 266° . On acid hydrolysis it gives 7-bromo-3-aminocoumarin, which forms pale cream-coloured needles melting at 205° .

218. "Studies in the azine series. Part II." By Kathleen Balls, John Theodore Hewitt, and Sidney Herbert Newman (Trans., 1912, 1840.)

The question of the ortho- or para-quinonoid nature of the safranines has been examined, and several reactions lead to the detection of only one amino-group at a time in the phenosafranine molecule (monacid salts); thus not only can one amino-group alone be diazotised in solutions of medium acid concentration, but phenosafranine condenses with one molecule of benzaldehyde; whilst tetramethylsafranine unites with one molecule of methyl iodide.

The absorption spectra of several derivatives of phenylphenazonium have been measured.

219. "Properties of mixtures of allyl alcohol, water, and benzene. Part II." By Thomas Arthur Wallace and William Ringrose Gelston Atkins. (Trans., 1912, 1958.)

Pure allyl alcohol has D_0° 0.86911 and boils at 97.06° . It forms the following mixtures of constant boiling point:

Alcohol, per cent.	Benzene, per cent.	Water, per cent.	Boiling point.
72.00	—	28.00	88.00°
17.36	82.64	—	76.75
9.16	82.26	8.58	68.21

The alcohol when mixed with water shows a large, and with *n*-propyl alcohol a slight, contraction in volume; with benzene, however, there is a small expansion.

The above data show that by distillation of the aqueous alcohol, and subsequent addition of benzene to the alcohol-water binary mixture, a pure anhydrous allyl alcohol may be obtained in quantity.

220. "Some new diazoamino- and *o*-aminoazo-compounds."

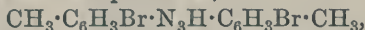
By George Marshall Norman. (Trans., 1912, 1913.)

Aminoazo-compounds have been obtained from 4:4'-dibromo- and 4:4'-dichloro-diazoaminobenzene by heating these compounds at 65° with excess of the corresponding amine and one molecule of its hydrochloride.

4:4'-Dibromo-2-aminoazobenzene, $\text{C}_6\text{H}_4\text{Br}\cdot\text{N}_2\cdot\text{C}_6\text{H}_3\text{Br}\cdot\text{NH}_2$, forms red needles, m. p. 146—147°.

4:4'-Dichloro-2-aminoazobenzene forms bright red plates with a green reflex, m. p. 140°.

3:3'-Dibromodiazamino-*p*-toluene,



crystallising in yellow needles, m. p. 111°, could not be transformed into an azo-compound by heating with 3-bromo-*p*-toluidine and its hydrochloride.

β -Naphthalenediazamino-*p*-chlorobenzene, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{N}_3\text{H}\cdot\text{C}_{10}\text{H}_7$, crystallises in dark yellow needles, m. p. 156°.

β -Naphthalenediazamino-*p*-toluene, when heated with *p*-toluidine and its hydrochloride, gave a good yield of *p*-tolueneazo- β -naphthylamine.

o-Tolueneazo- β -naphthylamine, $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{N}_2\cdot\text{C}_{10}\text{H}_6\cdot\text{NH}_2$, forms long, dark red needles, m. p. 122°. It is produced either by the action of *o*-toluenediazonium chloride on β -naphthylamine, or by the action of β -naphthalenediazonium chloride on *o*-toluidine.

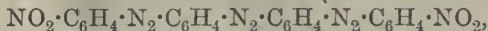
m-Tolueneazo- β -naphthylamine is produced by the action of *m*-toluenediazonium chloride on β -naphthylamine. It crystallises in small, orange-red needles, m. p. 102°.

By the action of β -naphthalenediazonium chloride on *m*-toluidine there is produced in small quantity β -naphthalenediazamino-*m*-toluene, $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{N}_3\text{H}\cdot\text{C}_{10}\text{H}_7$, which crystallises in thin, yellow plates, m. p. 183°.

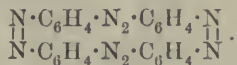
The action of nitrous acid on the azo-compounds, and of β -naphthol on some of the diazoamino-compounds mentioned, has also been studied.

221. "The alkaline condensations of nitrohydrazo-compounds. Part II." By Arthur George Green and Frederick Maurice Rowe. (Trans., 1912, 2003.)

When bisnitrobenzeneazo-azobenzene (dinitrotrisazobenzene),

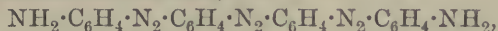


is reduced with phenylhydrazine and sodium hydroxide, it is converted into *tetrakisazobenzene*,



This is a red, granular substance of high melting point, which is the nitrogen analogue of Mikado-orange, and like this dyestuff it dissolves in concentrated sulphuric acid with a pure blue colour. The analogy between the condensations which give rise to bisnitrobenzeneazo-azobenzene and those by which the stilbene dyestuffs are formed, is thus confirmed.

As a by-product in the reduction there is also produced the bisaminobenzenaeazo-azobenzene,



recently described by Witt and Kopetschni (*Ber.*, 1912, **45**, 1147). This crystallises from xylene in garnet-red crystals, which melt at 294°.

222. "The absorption spectra of simple aliphatic substances in solutions, vapours, and thin films. Part I. Saturated aldehydes and ketones." By John Edward Purvis and Nial Patrick McClelland. (Trans., 1912, 1810.)

A comparative study of the absorption spectra of various simple aliphatic aldehydes and ketones has been made in order to determine in what direction, and how far, the absorption of light is affected when they are in different physical conditions. The phenomena are discussed from a consideration of the vibrations having their primary oscillations originating in definite oscillation centres.

223. "The influence of certain salts on the dynamic isomerism of ammonium thiocyanate and thiocarbamide." By William Ringrose Gelston Atkins and Emil Alphonse Werner. (Trans., 1912, 1982.)

In continuation of the work already published (*Trans.*, 1912, 101, 1167), experiments have been made in the hope of obtaining evidence likely to throw further light on the reversible isomerism

of the above two compounds. The action of heat on the compounds $(\text{CsN}_2\text{H}_4)_4\text{KI}$, m. p. 189° , $(\text{CsN}_2\text{H}_4)_4\text{CsI}$, m. p. 191° , and $(\text{CsN}_2\text{H}_4)_4\text{RbI}$, m. p. 202° , has been studied; in each case the equilibrium percentage of thiocarbamide was lowered, as compared with the normal 25 per cent. It was found to be about 14 per cent. in the case of the potassium iodide compound, and about 16 per cent. with the other two.

The influence of the chlorides, bromides, and iodides of potassium, sodium, and ammonium on the reversion of thiocarbamide and ammonium thiocyanate at 170° has been studied; sodium iodide differs from the other salts by effecting an almost complete reversion of thiocarbamide.

The action of heat on the compound $(\text{CsN}_2\text{H}_4)_3\text{KSCN}$ has also been examined; in this case the normal equilibrium was not disturbed.

Several new additive compounds of thiocarbamide with saline iodides have been prepared for comparative study. Whilst tetramethylammonium iodide does not form a compound with thiocarbamide, the additive compound $(\text{CsN}_2\text{H}_4)_2\text{NMe}_3\text{EtI}$, m. p. 141° , was readily obtained.

224. "The molecular condition of some organic ammonium salts in bromoform." By William Ernest Stephen Turner. (Trans., 1912, 1923.)

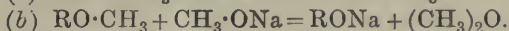
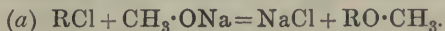
In continuation of the author's investigation (*Trans.*, 1911, **99**, 880), the molecular complexities of twelve salts of organic ammonium bases have been determined in bromoform. The results confirm the author's previous conclusions based on the use of chloroform as a solvent, and indicate that these salts are strongly associated, the extent depending on the character of the salt, on the concentration of the solution, and on the solvent employed.

Association in bromoform is even more pronounced than in chloroform, and the conclusion is drawn that the probable cause is to be traced to the lower dielectric constant of bromoform. The effect of the solvent on the molecular weight differs, however, from salt to salt.

225. "The action of sodium methoxide on 2:3:4:5-tetrachloropyridine. Part II." By William James Sell. (Trans., 1912, 1945.)

The action of sodium methoxide on 2:3:4:5-tetrachloropyridine has been studied on a fairly large scale at the ordinary pressure

in a flask heated by immersion in a water-bath, the experiments being conducted in two series, namely, (1) in which the sodium methoxide solution was of moderate strength, the main product being 3:5-dichloro-2:4-dimethoxypyridine; no methyl ether was produced. (2) In which the sodium methoxide was of such strength as to solidify on cooling, and the only products were 3:5-dichloro-4-hydroxy-2-methoxypyridine and methyl ether. The methyl ether is believed to be the product of the further action of sodium methoxide on the pyridine methoxide first produced, thus:



Some evidence is adduced as to the constitution of the chief products of this reaction, and it is indicated that at a temperature below the boiling point of water the 4-methoxy-group in the 3:5-dichloro-2:4-dimethoxy-compound is converted into the hydroxy-group, but that it requires a considerably higher temperature to effect the conversion of the methoxy-group in the 2-position.

226. "The preparation of glycogen and yeast-gum from yeast."

By Arthur Harden and William John Young. (Trans., 1912, 1928.)

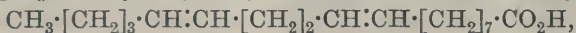
The method previously described for the preparation of pure glycogen from yeast (*Trans.*, 1902, **81**, 1224) has been simplified by adopting the procedure of Pflüger for the preliminary extraction and purification. By the process described, glycogen is obtained which contains no nitrogen and only 0.02 per cent. of ash. From the filtrate, after removal of the glycogen, yeast-gum is obtained as a white powder dissolving in water to a clear solution, which gives no red colour with iodine, produces a bulky, flocculent precipitate when warmed with Fehling's solution, and yields mannose when hydrolysed by boiling with acid.

227. "Studies of Chinese wood oil. β -Elæostearic acid."

By Robert Selby Morrell. (Trans., 1912, 2032.)

Further investigation of the glyceride produced when Chinese wood oil is exposed to light seemed advisable in view of the diversity of opinion as to the structure of elæostearic acid. The results obtained confirm many of the statements of previous investigators. β -Elæostearic acid (m. p. 72°) and its glyceride (m. p. $61-62^\circ$) are stereoisomerides of α -elæostearic acid (m. p. 48°) and its liquid glyceride. With the exception of the potassium salt, the derivatives of the acid absorb oxygen with great rapidity, and in several

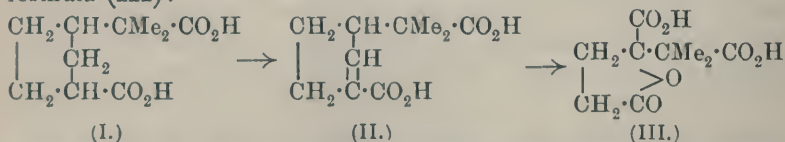
cases it was impossible to prevent oxidation before analysis. Oxidation of the potassium salt by alkaline permanganate gave *n*-valeric and azelaic acids, together with substances showing the pyrrole reaction. Tartaric and succinic acids could not be detected among the oxidation products. Ethyl β -elæostearate (b. p. 232°/14 mm.) undoubtedly contains only two doubly-linked carbon atoms. The reactions of elæostearic acid are best expressed by the constitutional formula proposed by Majima (*Ber.*, 1909, **42**, 674), namely,



Preliminary investigations of the action of oxygen and air on the salts of β -elæostearic acid have shown that the gain in weight depends on the nature of the salt. During the oxidation of the glyceride a change from crystalline to spongy character occurs without alteration in colour. If the temperature is raised to 100° there is a sudden change in colour and oxidation products (aldehydes and acids) are expelled.

228. "The constitution of camphene. Part I. The structure of camphenic acid." By Walter Norman Haworth and Albert Theodore King. (Trans., 1912, 1975.)

Aschan (*Annalen*, 1910, **375**, 336) ascribes to camphenic acid the constitution (I); to dehydrocamphenic acid (II); and to the product of the oxidation of this with nitric acid, the lactonic acid formula (III):



By the aid of a Reformatsky condensation between ethyl α -ketoglutarate and ethyl α -bromoisobutyrate, the authors have synthesised a lactonic acid having the constitution represented by (III), which, however, is not identical with the lactonic acid obtained by Aschan by the oxidation of dehydrocamphenic acid. Consequently, some modification of the above accepted structure (I) for camphenic acid must be adopted.

229. "Studies in phototropy and thermotropy. Part III. Arylideneamines." By Alfred Senier, Frederick George Shephard, and Rosalind Clarke. (Trans., 1912, 1950.)

The effect of light on the Schiff's bases, which are phototropic at the ordinary temperature, has been studied at temperatures up

to their melting points, and some bases which are not phototropic at the ordinary temperature have been submitted to the action of light at lower temperatures in order to find out if they might not exhibit phototropy under such conditions. In the first case it has been found that whilst some Schiff's bases are phototropic at temperatures up to their melting points, others have a limiting temperature, above which they are not phototropic; secondly, of the compounds examined at lower temperatures, two, namely, salicylidene-*p*-anisidine and 2-hydroxy-3-methoxybenzylidene-*p*-xylidine, were found to be phototropic.

The colour changes which take place in salicylidene- β -naphthylamine (Senier and Shephard, *Trans.*, 1909, **95**, 1950) have been further investigated, and it has been found that this compound is phototropic at the ordinary temperature, but that the darker phototrope only changes very slowly into the lighter one. Salicylidene- β -naphthylamine, similar to some other anils of this series, can be obtained in two forms, yellow and red, by varying the method of preparation, and it is now shown that these modifications are identical with the light and dark phototropes.

To the list of phototropic Schiff's bases already known, the following compounds have been added: *salicylidene-o-anisidine*, *disalicylidene-m-phenylenediamine*, and *2-hydroxy-3-methoxybenzylidene-p-xylidine*, which have not hitherto been described, and salicylidene-aniline, salicylidene-*o*-bromoaniline, salicylidene-*p*-bromoaniline, and salicylidene-*p*-anisidine, already described, but with no mention hitherto of their phototropic properties.

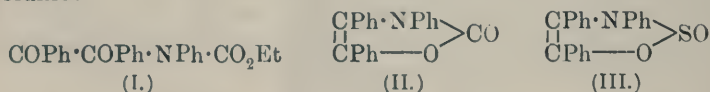
230. "Studies of the constitution of soap in solution: sodium myristate and sodium laurate." By James William McBain, Elfrieda Constance Victoria Cornish, and Richard Charles Bowden. (*Trans.*, 1912, 2042.)

The anomalous conductivity curve for sodium palmitate at 90° is closely paralleled by that of the very much more mobile sodium myristate solutions. The curve for sodium laurate is much less anomalous in that the maximum and minimum are obliterated. Only the degree, and not the position, of the abnormality in the curves is altered in passing down the homologous series from stearate to laurate. The conductivity curves of sodium myristate at a number of temperatures between 90° and 40° reveal a very high temperature-coefficient, which, however, is nearly uniform for all concentrations, so that the position and degree of development of maximum and minimum is largely unaffected. Finally, a number of qualitative observations closely bearing on the colloid theory of

soap solutions and "supersaturation" of gelatinisation are discussed. The coagulation of a suspensoid or gelatinisation of an emulsoid does not appear to be connected with change in the degree of dispersion of the colloid in certain cases.

231. "The condensation of α -keto- β -anilino- $\alpha\beta$ -diphenylethane and its homologues with ethyl chlorocarbonate and thionyl chloride."
By Hamilton McCombie and John Wilfred Parkes. (Trans., 1912, 1991.)

Some of the acyl derivatives of α -keto- β -anilino- $\alpha\beta$ -diphenylethane were found by Everest and McCombie (*Trans.*, 1911, 99, 1746) to undergo condensation with ammonia to yield glyoxalines. In continuation of this work, the authors have prepared the carbethoxy-derivatives of α -keto- β -anilino- $\alpha\beta$ -diphenylethane (I) and its homologues. The carbethoxy-compound (I), when heated with ammonia in a sealed tube, was found to yield 2-keto-3:4:5-triphenyl-2:3-dihydro-oxazole (II), the ammonia merely acting as a hydrolysing agent. It was found that this oxazole could be prepared more conveniently from the carbethoxy-compound by the action of alcoholic potassium hydroxide, or directly from α -keto- β -anilino- $\alpha\beta$ -diphenylethane by the action of carbonyl chloride in presence of pyridine:



The dihydro-oxazoles, which have been prepared, are found to be very stable towards acids and alkalis, they resist the action of reducing agents, and are not sufficiently basic to form salts.

The reaction between thionyl chloride and α -keto- β -anilino- $\alpha\beta$ -diphenylethane and its homologues was also investigated. In this case, the compounds obtained (III) were analogous to the oxazoles described above, having the CO-group replaced by the SO-group. The authors suggest the name oxasulphinazole for this new heterocyclic ring, so that compound (III) would be 3:4:5-triphenyloxasulphinazole.

Like the oxazoles, the oxasulphinazoles were found to be extremely unreactive.

Attempts were also made to substitute sulphuryl chloride for thionyl chloride in this reaction, but no ring compounds were obtained, only chloro-derivatives of the original α -keto- β -anilino- $\alpha\beta$ -diphenylethane being produced.

232. "Carbon disulphide as solvent for the determination of the 'refraction constant.'" By Frédéric Schwers. (Trans., 1912, 1889.)

Some new experiments have been made on the density and refractive index of binary mixtures, and the results calculated according to the formula which was theoretically explained in previous papers.

Measurements were made with mixtures of carbon disulphide with aliphatic acids (acetic, *isobutyric*, *isovaleric*) and alcohols (ethyl and *isobutyl*), and the refraction constant "A" was calculated and compared with the value for the corresponding solutions in water. Some differences are to be noted between the two kinds of solutions, namely, (1) there occurs a dilatation of both density and refractive index in the case of carbon disulphide mixtures, and not a contraction as in the case of aqueous solutions; (2) the absolute values of "A" are much smaller than for the corresponding solutions in water; moreover, there does not exist an absolute proportionality between these A-values in carbon disulphide and aqueous solutions. On the other hand, solutions in carbon disulphide have important points in common with those in water, namely, (1) by comparing solutions of carbon disulphide with the different terms of a series, it appears that "A" diminishes with the increase of the molecular weight; (2) increase of temperature produces increase of "A"; (3) the refraction constant diminishes from the red to the violet end of the spectrum.

233. "The electrochemistry of solutions in acetone. Part II. The silver nitrate concentration cell." By Alexander Roshdestwensky and William Cudmore McCullagh Lewis.

Employing a more sensitive form of capillary electrometer, further measurements have been carried out on the *E.M.F.* of concentration cells containing silver nitrate in acetone. The *E.M.F.* values were found not to be affected by the interposition of a silver nitrate solution of arbitrary concentration; and taking this into account along with results previously obtained, the conclusion is drawn that the Nernst formulæ are applicable. On this basis the transport numbers of the ions of silver nitrate in acetone have been calculated.

Measurements have also been carried out with saturated ammonium acetate as the middle liquid.

234. "The influence of neutral solvents on velocity of reaction. Part II. Transformation of anissynaldoxime in various solvents." By Thomas Stewart Patterson and Harvey Hugh Montgomerie.

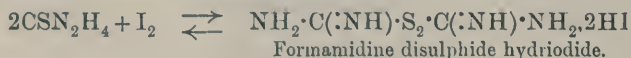
The influence of neutral solvents on the velocity of transformation of anissynaldoxime into anisantaldoxime has been studied, the transformation being rendered apparent by a corresponding alteration in the rotation of ethyl tartrate used as an indicator.

235. "The condensation of pentaerythritol with aldehydes." By John Read. (Trans., 1912, 2090.)

The condensation products of pentaerythritol with a number of aldehydes have been made and investigated with a view to their resolution into enantiomorphously related isomerides.

236. "The interaction of iodine and thiocarbamide. The properties of formamidine disulphide and its salts." By Emil Alphonse Werner.

Iodine and thiocarbamide interact in presence of an ionising solvent in accordance with the equation:



The amount of the hydriodide of the base produced is inversely proportional to the concentration of the products when equilibrium is established, and directly proportional to the ionising power of the solvent. In presence of nitric acid a quantitative yield of the dinitrate, $\text{C}_2\text{S}_2\text{N}_4\text{H}_6, 2\text{HNO}_3$, is obtained. Three final results can be realised under different conditions, namely, (1) quantitative formation of formamidine disulphide, (a) with concentrated solutions of the components, (b) in a high degree of dilution, and (2) a condition of equilibrium in which the base and thiocarbamide are present in equivalent proportions, $\text{C}_2\text{S}_2\text{N}_4\text{H}_6 : 2\text{CSN}_2\text{H}_4$. An additive compound, $(\text{CSN}_2\text{H}_4)_2\text{I}_2$, is formed only when iodine and thiocarbamide are allowed to interact in presence of benzene or chloroform. It melts at 87° , and when brought in contact with water, or other ionising solvent, is converted into formamidine disulphide hydriodide (m. p. 81°).

Claus' compound, $(\text{CSN}_2\text{H}_4)_2\text{Cl}_2$ (*Annalen*, 1875, 179, 139), is the hydrochloride of the base.

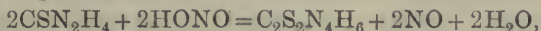
The *picrate* (m. p. 154°), *platinichloride*, and the compound $C_2S_2N_4H_6 \cdot 2HI \cdot I_2$ are described.

The action of potassium iodide in increasing the dissociation of the hydriodide, with generation of thiocarbamide and iodine, has been examined, and its influence on the estimation of thiocarbamide by *N*/10-iodine solution is pointed out. The production of formamidine disulphide by oxidising agents, such as potassium permanganate, nitrous acid, and hydrogen peroxide on thiocarbamide, only takes place in presence of strong acids, whilst with iodine the base is produced just as readily in neutral solution. An explanation of the probable mechanism of the interaction is given, which accounts for the formation of the base by the action of iodine under conditions different from those necessary with the oxidising agents mentioned.

237. "The action of nitrous acid on thiocarbamide and on formamidine disulphide. A new structural formula of thiocarbamide." By Emil Alphonse Werner.

When nitrous acid and thiocarbamide interact, the change proceeds in two different directions according as a weak or a strong acid is present.

In the presence of a weak acid the interaction is expressed by the equation $CSN_2H_4 + HONO = HSCN + N_2 + 2H_2O$, as proposed by A. E. Dixon (*Trans.*, 1892, **61**, 526), with a strong acid present, formamidine disulphide, $C_2S_2N_4H_6$ (Storch, *Monatsh.*, 1890, **11**, 452), is first produced thus:

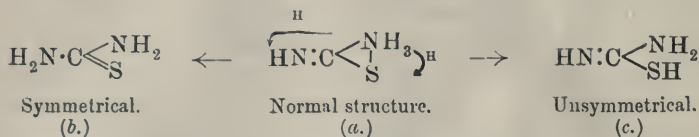


and this is decomposed by further action of nitrous acid with production of thiocyanic acid and evolution of nitrogen. The changes have been studied quantitatively, and the secondary reactions, which takes place to a small extent in both cases, have been explained.

Thiocarbamide can be used for the rapid and accurate assay of nitrites. To account for the different phenomena described, neither the symmetrical nor the unsymmetrical formula of thiocarbamide is sufficient, but a new formula, $HN:C \begin{smallmatrix} \nearrow NH_3 \\ \searrow S \end{smallmatrix}$, is proposed, as probably representing the true structure of thiocarbamide in a neutral solution, or in presence of a weak acid.

This formula shows a much closer connexion between thiocarbamide and ammonium thiocyanate than the other two, and readily explains how the compound may give rise to derivatives of the symmetrical or unsymmetrical structure, under different conditions,

by the migration of an atom of hydrogen in either of the directions shown below:



The change from (a) to (c) is determined by the presence of a strong acid or other strong negative reagent.

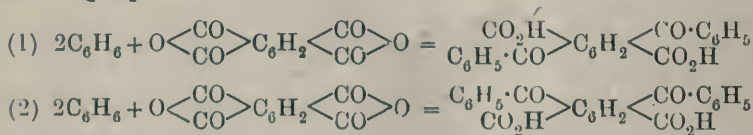
238. "The oxidation of some benzyl compounds of sulphur. Part I."

By John Armstrong Smythe. (Trans., 1912, 2076.)

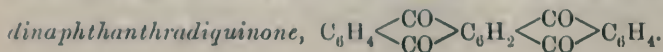
The comparative study of a number of benzyl compounds of sulphur has been undertaken. Oxidation is carried out with hydrogen peroxide in solution of glacial acetic acid. The simple monosulphidic compounds are converted quantitatively into higher oxy-derivatives, but the polysulphidic compounds suffer rupture. Benzyl disulphide yields benzyl disulphoxide, benzyldisulphonic acid, benzaldehyde, and sulphuric acid, and the last three are among the products of reaction of benzyl disulphoxide, benzyl mercaptan, and benzoyl benzyl sulphide. An explanation of this peculiarity is sought in the hydrolysis of the disulphoxide and subsequent reaction of the hydrolytic products.

239. "The synthetical production of derivatives of dinaphthanthracene." By William Hobson Mills and Mildred Mills.

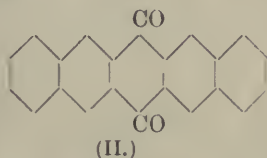
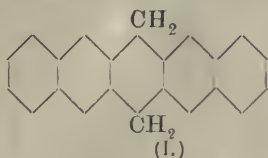
Under the influence of aluminium chloride, pyromellitic anhydride condenses with benzene, forming a mixture of 2:5-dibenzoyltetraphthalic acid and 4:6-dibenzoylisophthalic acid, as shown by the following equations:



The constitution of these acids has been established by fusion with potassium hydroxide, which decomposes them into benzoic acid, on the one hand, and terephthalic and isophthalic acids respectively on the other. When warmed with concentrated sulphuric acid, both of these acids lose two molecules of water and give rise to



This diquinone when reduced with zinc dust and alkali is converted into *dihydrodinaphthanthracene* (I); when heated with hydriodic acid and phosphorus it gives rise to two isomeric α - and β -*tetrahydrodinaphthanthracenes*.



α -Tetrahydrodinaphthanthracene on oxidation is converted successively into dihydrodinaphthanthracene (I), *dinaphthanthrone*, $C_{10}H_6 \begin{smallmatrix} \text{CO} \\ \text{CH}_2 \end{smallmatrix} C_{10}H_6$, and *dinaphthanthraquinone* (II). The constitution of dinaphthanthraquinone is established by the fact that it is decomposed by sodium hydroxide into a mixture of benzoic and β -naphthoic acids.

240. "The preparation of durylic and pyromellitic acids."

By William Hobson Mills.

The conditions are specified under which acetyl- ψ -cumene, which can readily be obtained in any quantity from ψ -cumene by the Friedel-Crafts reaction, can be converted easily and with a satisfactory yield into pyromellitic acid. The process consists in the transformation of the ketone by sodium hypobromite into durylic acid, and the subsequent oxidation of the latter with potassium permanganate.

241. "Organic derivatives of silicon. Part XV. The nomenclature of organic silicon compounds." By Frederic Stanley Kipping.

Some suggestions are made for systematising the nomenclature of different types of silicon compounds, more especially those described in the following papers.

242. "Organic derivatives of silicon. Part XVI. The preparation and properties of diphenylsilicanediol" By Frederic Stanley Kipping.

The hydrolysis of pure dichlorodiphenylsilicane under various conditions has been studied, and it has been found that the isolation of diphenylsilicanediol, $SiPh_2(OH)_2$, from the product is an exceptionally difficult task, partly owing to the readiness with which

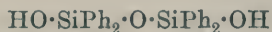
the diol undergoes condensation, giving compounds which it adsorbs from solutions.

Pure diphenylsilicanediol usually decomposes with effervescence at about 128—132°, but it is dimorphous, and in the neighbourhood of its decomposition point it may pass into a more stable, crystalline modification, which does not decompose and effervesce until about 150—160°; this change seems to occur always when the crystals of the diol contain relatively small quantities of some of its condensation products, but seldom takes place when the compound is pure, so that impure specimens appear to have a much higher decomposition point than the pure substance.

The isomeric "diphenylsilicols" described by Martin (*Ber.*, 1912, 45, 403) as melting at about 140° and 160° respectively were probably impure specimens of diphenylsilicanediol, and the methods which he gave for the conversion of these supposed isomerides into one another do not bring about any isomeric change.

243. "Organic derivatives of silicon. Part XVII. Some condensation products of diphenylsilicanediol." By Frederic Stanley Kipping.

Diphenylsilicanediol very readily undergoes condensation in presence of acids or alkalis, and in the preparation of the diol from dichlorodiphenylsilicane by different methods, various oily or glue-like products are obtained in considerable quantities. These products are usually mixtures of three or more compounds, which are formed from the diol by a process of condensation, and of which the following four have so far been isolated:



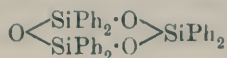
(I.)

Anhydrobisdiphenylsilicanediol.



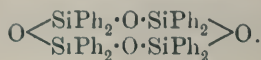
(II.)

Dianhydrotrisdiphenylsilicanediol.



(III.)

Trianhydrotrisdiphenylsilicanediol.



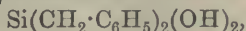
(IV.)

Tetra-anhydrotetrakisdiphenylsilicanediol.

The conditions under which these four condensation products are obtained from the diol have been studied, and also methods for the conversion of the two hydroxy-compounds (I and II) into their respective anhydro-derivatives (IV and III). The results of these and of further experiments which are in progress may throw some light on the constitutions of the complex mineral silicates.

244. "Organic derivatives of silicon. Part XVIII. Dibenzylsilicanediol and its anhydro-derivative." By Robert Robison and Frederic Stanley Kipping.

The further study of the compounds described as α -dibenzylsilicol and β -dibenzylsilicol (*Trans.*, 1908, **93**, 441) has shown that the former is a dibenzylsilicanediol of the constitution

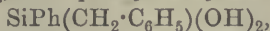


whereas the latter is an *anhydrobisdibenzylsilicanediol* of the constitution $\text{HO}\cdot\text{Si}(\text{CH}_2\cdot\text{C}_6\text{H}_5)_2\cdot\text{O}\cdot\text{Si}(\text{CH}_2\cdot\text{C}_6\text{H}_5)_2\cdot\text{OH}$, crystallised with one molecule of water; although, therefore, the two compounds have the same composition they are not isomeric.

Dibenzylsilicanediol is the primary product of the hydrolysis of dichlorodibenzylsilicane, and methods for the preparation of the pure diol are described. When heated, or when treated with various reagents, dibenzylsilicanediol undergoes condensation, yielding products from which anhydrobisdibenzylsilicanediol and trianhydrotrisdibenzylsilicanediol may be isolated, the former in hydrated crystals. These hydrated crystals lose their water at 100° , and give anhydrobisdibenzylsilicanediol as a viscid oil, which is so very hygroscopic that it passes into the hydrated crystals on exposure to moist air.

245. "Organic derivatives of silicon. Part XIX. The preparation and properties of some silicanediols of the type $\text{SiR}_2(\text{OH})_2$." By Robert Robison and Frederic Stanley Kipping.

Phenylethylsilicanediol, $\text{SiPhEt}(\text{OH})_2$, *benzylethylsilicanediol*, $\text{SiEt}(\text{CH}_2\cdot\text{C}_6\text{H}_5)(\text{OH})_2$, and *phenylbenzylsilicanediol*,



may be obtained by carefully hydrolysing the corresponding disubstituted dichlorosilicanes with an aqueous solution of ammonium hydroxide. These three crystalline compounds, like diphenylsilicanediol and dibenzylsilicanediol, give soluble derivatives with solutions of the alkali hydroxides; they are all very easily changed by heat and also by various reagents, giving oils which are doubtless mixtures of their condensation products.

Anhydrobisphenylethylsilicanediol, $\text{HO}\cdot\text{SiPhEt}\cdot\text{O}\cdot\text{SiPhEt}\cdot\text{OH}$, is formed when purified phenylethylsilicanediol is kept at the ordinary temperature, and also when an aqueous solution of the last-named compound is treated with a very little dilute hydrochloric acid.

246. "The purification, density, and expansion of ethyl acetate."
By John Wade and Richard William Merriman.

Defects in the methods of preparing dry esters, used by previous workers, are pointed out and overcome. The density at 0° compared with water at 4° was found to be 0.92454, which is higher than the values obtained by Perkin (*Trans.*, 1884, **45**, 492), and by Young and Thomas (*Trans.*, 1893, **63**, 1216). Reasons for this difference are given.

Taking the specific volume at 0° to be unity, the specific volumes at 10°, 20°, and 30° were found to be 1.01301, 1.02663, and 1.04080 respectively. A method of using a Dewar vacuum vessel as a constant-temperature bath is described.

247. "The vapour pressure of ethyl acetate from 0° to 100°."
By John Wade and Richard William Merriman.

For temperatures above 15° the boiling point of ethyl acetate was determined at constant pressure in the manner previously described by the authors (*Trans.*, 1911, **99**, 989). At each pressure a complete fractionation of 100 grams of pure ester was made, the temperature recorded being that at which Δ per cent. was a maximum (Wade, *Trans.*, 1905, **87**, 1656). At 100° the pressure found was 1536 mm., as compared with 1515 mm. obtained by Young and Thomas (*Trans.*, 1893, **63**, 1216). Reasons are advanced for regarding the new value as correct.

Below a pressure of 900 mm. the agreement with Young and Thomas is almost perfect. A new method was used for finding the vapour pressures below 15°.

248. "Halogen derivatives and 'refraction constant.'"
By Frédéric Schwers.

The anomalies with regard to the "refraction constant" shown by mixtures containing a halogen derivative have been submitted to a closer investigation. It appears that the irregular behaviour (as compared with other mixtures) of the C_v and C_n curves is related to the number of halogen atoms, and affects the density much more than the refractive index, which shows more regularity. Particularly curious are the mixtures alcohol-chloroform and acetone-chloroform; their density variations are positive for certain concentrations and negative for others, whereas the refraction changes in quite a different manner and in the most regular way. Interesting is the fact that mixtures of

halogen derivatives with fatty acids do not show the same phenomena. For the explanation of the observed phenomena, the hypothesis of an atom nucleus with variable volume (Richards) seems more necessary than ever.

The following communication has been received during the vacation:

249. "Bimolecular glycollaldehyde. A correction."

By Nial Patrick McClelland.

The author regrets that a mistake was allowed to pass unnoticed in the above paper (*Trans.*, 1911, **99**, 1827):

On p. 1829, line 17, for $C = \frac{M-60}{60}$ should be read $C = \frac{M-60}{M/2}$.

With this alteration the values of k become:

- (i) 0.00140 not 0.00210.
- (ii) 0.00196 „ 0.00303.
- (iii) 0.00381 „ 0.00561.

the variation from the mean value in only one instance exceeding 4 per cent.

This alteration in no way affects the conclusions arrived at in the paper.

At an Extra Meeting of the Chemical Society, held in the Large Theatre of Burlington House (by the kind permission of His Majesty's Office of Works) on Thursday, October 17th, 1912, at 8.30 p.m., Professor Percy F. Frankland, LL.D., F.R.S., President, in the Chair, Sir Oliver Lodge, D.Sc., F.R.S., delivered the Becquerel Memorial Lecture.

A vote of thanks to Sir Oliver Lodge, proposed by Sir William Crookes, O.M., F.R.S., and seconded by Professor H. E. Armstrong, F.R.S., was supported by the President and carried with acclamation.

Thursday, November 7th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society through death:

On August 7th, 1912, of Mr. Robert Holford MacDowall Bosanquet, F.R.S. (who was elected a Fellow on February 2nd, 1865);

On August 15th, 1912, of Dr. H. O. Jones, F.R.S.; and of Dr. John Wade.

The PRESIDENT read the following Address, which had been presented to the Royal Society on the celebration of the 250th Anniversary of its Foundation in July, 1912:

THE CHEMICAL SOCIETY

TO

THE PRESIDENT, COUNCIL, AND FELLOWS OF THE
ROYAL SOCIETY.

GREETING,

Amongst the many Learned Bodies represented here to-day there is certainly none which can wish to offer you more sincere and heartfelt congratulations than the Chemical Society.

The Officers, Council, and Fellows of our Society desire to associate themselves with you in celebrating the Two-hundred-and-fiftieth Anniversary of the birth of a scientific corporation which in the distinction of its history is assuredly second to no similar body in the World. The great army of diligent and determined workers who are united by the solemn covenant to extend Man's knowledge of Nature look with reverence and gratitude on the Society which, during two and a-half centuries, has kept alive in these Islands the sacred fire of Research, and has included within its Fellowship men whose names and achievements are amongst the most imperishable glories of the human race.

We desire to take this opportunity of expressing, however imperfectly, our indebtedness to the Society of *Boyle*, of *Cavendish*, of *Priestley*, of *Dalton*, and of *Davy*, and we are proud to remember that these early masters of our Science, by the stimulus which their investigations gave to the growth of Chemical Knowledge, led to the origin of our Society by a natural process of gemmation from your body. It is, therefore, in the capacity of children, and as an act of filial piety, that we desire to offer to you, our parents, dutiful felicitations to-day.

We would take this opportunity again of gladly and freely acknowledging before all men that whatever success our own Society may have achieved, whatever may be the dignity to which we have attained, and whatever service to Science and to Mankind we may have been privileged to perform, we largely owe to the

inspiration which our founders drew from the magnificent traditions of the Royal Society. This quickening influence has been, and, we trust, may long be, maintained by a close association with you, by the community of Fellowship which exists between your Society and ours, and by the kindred ideals and aspirations which animate us both.

Signed on behalf of the Chemical Society,

PERCY F. FRANKLAND, *President*.

ALEXANDER SCOTT, *Treasurer*.

ARTHUR W. CROSSLEY, } *Secretaries*.

SAMUEL SMILES,

HORACE T. BROWN, *Foreign Secretary*.

Sealed in Council this Twentieth Day of June, One Thousand Nine Hundred and Twelve.

It was announced that, during the vacation, the rooms of the Society had been redecorated throughout, and that a fan had been installed with the object of securing more efficient ventilation in the Meeting Room.

Messrs. T. V. Barker and W. E. Hawkins were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

James Henry Young Baker, 86, Chestnut Avenue, Hamilton, Ontario.

Douglas Anderson Bowack, 15, Belsize Square, Hampstead, N.W.
Richard Westman Challinor, Quidington, Emmerick Street, Leichardt, Sydney, N.S.W.

Frank Andrew Coombs, Sydney Technical College, Sydney, N.S.W.

Walter Henry Dixon, 51, High Street, East Grinstead.

H. H. Dodds, M.Sc., Explosives Works, Umbogintwini, Natal.

George Davidson Elsdon, B.Sc., City Analysts' Laboratory, Birmingham.

Harold Heath Gray, B.Sc., University Hall, More's Gardens, Cheyne Walk, Chelsea, S.W.

Ardesir Naserwanji Peston Jamas, M.A., B.Sc., Karrim Building, Grant Road, Bombay.

Edgar Jobling, B.Sc., H.M. Patent Office, Southampton Buildings, W.C.

Frederick Russell Lankshear, B.A., M.Sc., Dalton Hall, Victoria Park, Manchester.

Stanley Isaac Levy, B.A., B.Sc., St. John's College, Cambridge.

Ernest Lawson Lomax, M.Sc., Mowbreck, Farington, Preston.

George Francis Morrell, Ph.D., B.Sc., 7, Claylands Road, Kennington Gate, S.W.

Ernest Moore Mumford, B.Sc., 75, High Street, Chorlton-on-Medlock, Manchester.

Leslie Frank Newman, B.A., Downing College, Cambridge.

William Moore Nichols, 17, Ferrybridge Road, Castleford.

Maximilian Nierenstein, Ph.D., 30, Cavendish Road, Henleaze, Bristol.

Lionel Orange, B.Sc., 148, Barkworth Road, N. Camberwell, S.E.

John William Patterson, 88, Park Road, West Dulwich, S.E.

Charles Eddy Potter, B.Sc., 9, Church View, Church Lane, Heckmondwike.

Jitendra Nath Rakshit, 11/1, Bahar Urijapur Road, Calcutta.

Martin Remers, L.R.C.P., L.R.C.S., 24, Chorley Old Road, Bolton.

Albert Sasson, Department of Agriculture, Alexandria, Egypt.

Harold Archibald Scarborough, B.Sc., 60, Highbury Terrace, Hill Street, Coventry.

Walter Scott, 2, Wordsworth Avenue, Cardiff.

Kunjo Behary Seal, 5, Nilmony Dutt Lane, Calcutta.

Cyril Edgar Sladden, B.A., 12, Charleville Circus, Sydenham, S.E.

Thomas Alfred Smith, B.Sc., 3, Colegrave Street, Lincoln.

William Charles Smith, Church Lane, Lowton, Newton-le-Willows.

Victor Steele, 438, New Cross Road, New Cross, S.E.

Alfred Ernest Stephen, Bank of New South Wales, Sydney, N.S.W.

William Compton Till, M.Sc., Barnacle House, Coventry.

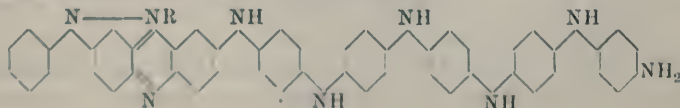
Paul Jenner Ure, c/o Dr. Ure, George Street, Brisbane, Queensland.

Of the following papers, those marked * were read:

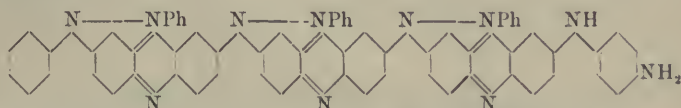
***250. "Aniline-black and allied compounds. Part III."**

By Arthur George Green and Salomon Wolff.

The authors have studied the action of various primary amines on nigraniline. They find that this base, when in a finely-divided state, reacts readily in the cold with neutral or weakly acid solutions of amine salts, giving compounds in which one molecule of amine has entered into combination with one molecule of nigraniline. The products obtained are represented as monoaryl-azonium compounds of the constitution:



In their formation a portion of the quinonoid groups has undergone reduction, and the product resembles protoemeraldine in character, although considerably blacker in colour. By treatment with hydrogen peroxide or chromic acid, by which the compound is reoxidised to a higher (probably tri-) quinonoid stage, it is enabled to react again with a further quantity of a primary amine; and on several repetitions of these alternate treatments three molecules of amine can eventually be introduced. At this stage the product (when aniline is the amine employed) has all the properties characteristic of "ungreenable aniline-black" produced on the fibre in the usual way. The analyses and properties agree with the constitution:



By employing *p*-bromoaniline in place of aniline, the corresponding tribrominated aniline-black, of very similar properties to the above, was obtained, the analysis of which substantiated the above formula.

Monoarylazonium compounds were also prepared and analysed, in which the reacting amines were *o*-toluidine, *p*-toluidine, *m*-bromoaniline, β -naphthylamine, toluidine, and diaminodiphenylmethane. All these products are very similar to the aniline condensation product.

***251. "The alkaline condensation of nitrohydrazo-compounds. Part III. Influence of ortho-groups on their formation and condensation." By Arthur George Green and Frederick Morris Rowe.**

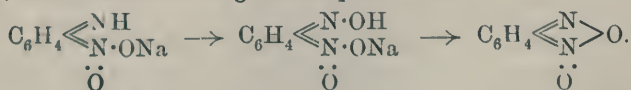
The presence of sulpho- or nitro-groups in the ortho-position with respect to basic nitrogen prevents or impedes the normal reactions; thus 2:4-dinitroaniline and *p*-nitroanilinesulphonic acid cannot under ordinary conditions be oxidised to the azo-compounds, nor can their corresponding hydrazines be condensed with chloronitro-compounds to give hydrazo-compounds, except with the extremely reactive picryl chloride. A search for the cause of this impeding action, which is the exact reverse of that observed in the derivatives of *p*-nitrotoluene, pointed to its being due to the occurrence of condensation between the basic nitrogen group and the *o*-nitro- or *o*-sulphonic group. This was confirmed by the observation that when *o*-nitroaniline is oxidised with hypochlorites in alkaline solution it is converted entirely into benzisooxadiazole (benzofurazan)

oxide ("dinitrosobenzene") (see following abstract), whilst the normal oxidation to 2:2'-dinitroazobenzene only occurs when strictly neutral conditions are maintained, that is, when isomerisation of the nitroamine into its quinonoid form is prevented.

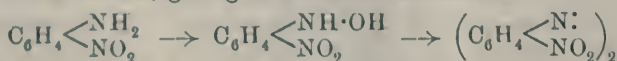
A similar condensation appears to occur when the hydrazo-compounds containing *o*-nitro-groups are treated with alkalis, and consequently the blue quinonoid salts of these compounds are very unstable. The conditions of formation and reaction were studied for the following azo- and hydrazo-compounds: The 2:2'-dinitro-, 2:4:2':4'-tetranitro- and 2:2'-dichloro-4:4'-dinitro-azobenzenes; the 2:2'-dinitro-, 2:4:4'-trinitro-, 2:4:2':4'-tetranitro-, 2:4:6:4'-tetranitro-, 2:4:6:2':4'-pentanitro-, 2:4:6:2':4':6'-hexanitro-, and 2:2'-dichloro-4:4'-dinitro-hydrazobenzenes.

*252. "The existence of quinonoid salts of *o*-nitroamines and their conversion into oxadiazole oxides." By Arthur George Green and Frederick Morris Rowe.

In the course of the previous investigation it was observed that when *o*-nitroaniline is oxidised with hypochlorites in strongly alkaline solution it is quantitatively converted into the compound hitherto known as "dinitrosobenzene" or "*o*-benzoquinonedioxime peroxide." This reaction, together with several other considerations, has led the authors to believe that the compound and its analogues are more correctly represented as benzisooxadiazole (benzfurazan) oxides, and that the change takes place thus:



This formula for the product involves no migration of an oxygen atom, either here or in Zincke and Schwartz's method of formation from *o*-nitrotriazobenzene. If its correctness is admitted, the reaction affords strong support for the existence of *aci*-quinonoid salts of *o*-nitroamines, and this conclusion is still further strengthened by the observation that *o*-nitroaniline dissolves in alcoholic potassium hydroxide with an orange-red colour, and that the oxidation in neutral solution takes an entirely different and more normal course, giving 2:2'-dinitroazobenzene:



The formation of benzisooxadiazole (benzfurazan) oxides by alkaline oxidation of *o*-nitroamines appears to be a general one, and affords a convenient method of preparing these compounds.

*253. "The essential oil of cocoa."

By James Scott Bainbridge and Samuel Henry Davies.

The authors find that the aromatic principle of the cocoa bean is an essential oil.

Two thousand kilos. of cocoa nibs were subjected to distillation with steam. From the distillate 24 c.c. of a purified oil were isolated, which proved to be a mixture of esters formed during the fermentation of the cocoa bean with the true essential oil. The latter consists chiefly of a *d*-linalool. Octoic acid and other fatty acids probably derived from cocoa-butter were present, and a small proportion of a stable nitrogenous compound, which was not identified.

*254. "Studies in chemical crystallography. Part I. Co-ordination, isomorphism, and valency." By Thomas Vipond Barker.

Some new cases of isomorphism of unusual types were described, the bearing of which on chemical and crystallographic theory was discussed. The conclusion was drawn that the ordinarily accepted theory of valency structure is incapable of offering any useful information concerning the structure of the compounds in question. Co-ordination structures, on the other hand, bring out pronounced chemical analogies, from which it is inferred that such structures are not only supported by the crystallographic evidence, but also are more general in inorganic compounds than was formerly suspected. The theories of Sollas and of Barlow and Pope were criticised from the point of view of isomorphism, and the conclusion was drawn that Barlow and Pope's theory in its present form is certainly incapable of general application to inorganic compounds. The view is entertained that the true volume unit in crystalline structures is the atomic rather than the valency volume.

*255. "The oxidation of aconitine." By Francis Howard Carr.

It was shown that a neutral substance, *oxonitin*, $C_{23}H_{29}O_9N$, together with acetaldehyde, results from the oxidation of aconitine with potassium permanganate in acid solution. Oxonitin crystallises in white, prismatic crystals, m. p. 276—277°; it is sparingly soluble in all solvents, neutral in reaction, and does not combine with acids or alkalis, nor does it give a precipitate with the common alkaloidal reagents. Methyl iodide, hydroxylamine, and acetic anhydride fail to act upon it. It contains three methoxyl groups, and since it gives, like aconitine, acetic and benzoic acids

on hydrolysis, it contains also an acetyl and benzoyl group. It may be presumed that the $N\cdot CH_3$ -group contained in aconitine is unchanged; its constitution may therefore be represented thus:



Oxonitin yields different products according as the hydrolysis is brought about by alkali or by hydrochloric acid; in the former case a neutral substance, and in the latter an alkaloid, is produced; in both instances acetic and benzoic acids are formed. The investigation is being continued with a view to the elucidation of the constitution of the hydrolytic substances and of the hypothetical base, $C_{10}H_{15}O_2N$.

DISCUSSION.

Mr. BRADY said that he had been working on the compound described for some time, but had not been able to establish the presence of the acetyl group, and inquired how the author had identified it.

256. "Some time-reactions suitable for lecture experiments."

By William Gerald Glendinning and Alfred Walter Stewart.

In concentrated solution, potassium iodide, potassium persulphate, and starch react practically instantaneously, producing starch-iodine blue. When sodium thiosulphate is also present, the appearance of the colour takes a longer or shorter time according to the amount of thiosulphate added. When carried out in the way described below, the reaction forms a simple demonstration of induction periods.

The solutions required are $M/5$ -potassium iodide, $N/10$ -thiosulphate, a saturated solution of potassium persulphate, and some starch solution. A burette is filled with the thiosulphate solution and fixed over a vessel into which are placed 10 c.c. of the iodide solution, 5 c.c. of the persulphate solution, and 5 c.c. of the starch solution. The starch-iodine blue is formed immediately, and is exactly removed by the thiosulphate. If three extra drops of the thiosulphate are added, the blue colour will not return until a lapse of sixty-three seconds; and if six or nine drops be used, the period is correspondingly prolonged. In more dilute solutions, of course, much longer intervals are obtained.

In order to avoid error in timing, due to adding the thiosulphate drop by drop, the following device may be employed. A T-piece is passed through a loosely-bored cork, which is clamped above the vessel used for the reaction in such a way that the T-piece lies horizontally. A second cork with a flat side cut on it is fixed

firmly on the straight end of the T-piece. The requisite number of drops of thiosulphate solution are then dropped on to a microscope cover glass, which rests on the flat cork; and when it is necessary to add this to the solution, the T-piece is turned round in the bore of the cork so that the cover glass drops off the flat side into the reaction vessel. In this way the whole of the thiosulphate can be added at once. An ordinary square cover glass will retain ten drops easily if care is taken.

The quantities given above are sufficient to allow of the successive addition of three, six, and nine drops of thiosulphate solution without exhausting the other reagents to an undue extent.

Two modifications of the above reaction are as follows: A solution of hydrogen peroxide may be substituted for the persulphate solution, the rest of the reagents remaining the same. In this case, if several titrations have to be carried out with the same solution, it is advisable to add some fresh starch each time the solution is rendered colourless, as otherwise a good tint is not obtained. Using 2 c.c. of potassium iodide solution, 10 c.c. of hydrogen peroxide solution (approximately 20 volumes), 8 c.c. of starch solution, and 50 c.c. of water, when three drops of thiosulphate solution are added the colour appears after about half a minute, the reaction being much more rapid than when potassium persulphate is used.

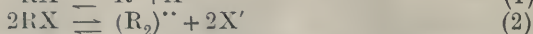
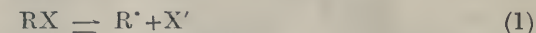
Instead of using hydrogen peroxide itself, a saturated solution of barium peroxide may be employed; but in this case certain modifications are necessary. The method of working is as follows: The barium peroxide solution is placed in the reaction vessel, and to it some phenolphthalein is added. Sufficient hydrochloric acid to decolorise the phenolphthalein is poured in; and then the starch and potassium iodide are added. The starch-iodine blue is decolorised with thiosulphate as before, and a small excess of thiosulphate added. Should the liquid show any signs of becoming alkaline, as can be seen from the phenolphthalein tint reappearing, a few drops of hydrochloric acid are added. It is inadvisable to have a large excess of acid owing to its effect on the thiosulphate solution.

257. "The problem of strong electrolytes. (Preliminary note.)"
By James Kendall.

The dissociation formula $m^2/(1-m)v=k+c \cdot (1-m)/m$ has been recently shown by the author from experimental results (*Trans.*, 1912, 101, 1275) to hold for all acids. The above formula may be arrived at theoretically by the assumption of the presence of complex ions of the type $(R_2)''$ or $(X_2)''$ in the aqueous solution of

an electrolyte RX . This is already known to be the case for mercurous chloride, which ionises as $(Hg_2)^{++}(Cl')_2$.

The equations for equilibrium, under the assumption of one complex ion, are of the form:



Let the undissociated ratio at dilution v be $1-m$; of the total dissociated part m let n , in the case of one ion, be complex.

Then, applying the law of mass action to the balanced equations (1) and (2) above, we obtain:

$$(m/v) \cdot [(m-n)/v] = k \cdot (1-m)/v \quad (3)$$

$$(n/2v) \cdot (n^2/v^2) = (c/2) \cdot (1-m)^2/v^2 \quad (4),$$

where k and $c/2$ are constants.

From equation (4) we have $n = cv(1-m)^2/m^2$; substituting for n in (3) we finally arrive at the equation:

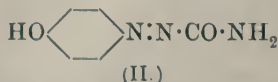
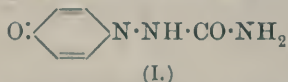
$$m^2/(1-m)v = k + c \cdot (1-m)/m \quad (5),$$

already found by experiment to hold in the case of all acids.

By the assumption that the ions form complexes of the above type in aqueous solution, the above dissociation formula, first obtained experimentally for acids only, may be extended to cover all uni-univalent electrolytes.

258. "Action of semicarbazide hydrochloride on the *p*-quinones. (Preliminary note.)" By Isidor Morris Heilbron and James Alexander Russell Henderson.

Thiele and Barlow (*Annalen*, 1898, **302**, 315) and Borsche (*ibid.*, 1904, **334**, 143) have already examined the action of semicarbazide hydrochloride on *p*-benzoquinone and on some of its derivatives, and found that the compounds formed gave phenols on treatment with sodium hydroxide. They suggest that the condensation products exist in tautomeric forms as semicarbazones (I) and μ -hydroxyazoformamides (II):



It seemed, however, to the authors that further evidence was necessary to decide the true constitution of the free condensation products. A spectrographic investigation has been made of the substances obtained by the action of semicarbazide hydrochloride on various *p*-quinones, as well as of the salts and esters of these products. The absorption curves of all the products are very similar, and practically identical in shape and position to those

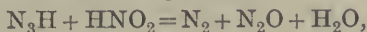
obtained by Tuck (*Trans.*, 1907, **91**, 449) for the *p*-hydroxyazo-compounds.

The *p*-quinone condensation products with semicarbazide hydrochloride are therefore true hydroxyazo-compounds of the type (II).

The investigation is at present being extended to other similar types of compounds.

259. "The interaction of azoimide and nitrous acid. (Preliminary note.)" By Emil Alphonse Werner.

Whilst the decomposition of hydrazine by nitrous acid constitutes one of the numerous methods by which azoimide may be obtained, the further action of nitrous acid on azoimide does not appear to have been hitherto examined. When a solution containing sodium azide and sodium nitrite is treated with dilute sulphuric or acetic acid, interaction immediately takes place with brisk evolution of gas, consisting of nitrogen and nitrous oxide. The change takes place in accordance with the equation:



and even with very dilute solutions the reaction is completed in a few minutes.

This interaction may be made the basis of a simple and rapid method for the analysis of azides, either by carrying out the decomposition in a nitrometer and measuring the volume of evolved gas, or by titration of a dilute solution of the azide, previously acidulated with dilute sulphuric acid, with a *N*/10-solution of sodium nitrite.

The following results were obtained with a sample of commercial sodium azide (Schuchardt) in a preliminary trial.

I. 0.05 gram of the azide and 0.06 gram of sodium nitrite (95 per cent.) dissolved in 1.5 c.c. of water were introduced into a nitrometer, and 0.5 c.c. of dilute sulphuric acid was added.

Gas evolved = 33.55 c.c. (dry) at 0° and 760 mm.

0.05 Gram of pure sodium azide requires 34.46 c.c.

Hence, 97.35 per cent. of pure sodium azide was present in the sample.

II. A solution was prepared by dissolving 1 gram of the sodium azide in 100 c.c. of water.

Ten c.c. diluted with 70 c.c. of water, and 2 c.c. of dilute sulphuric acid (1:7) added, were titrated with a *N*/10-solution of sodium nitrite (1 c.c. = 0.0065 N_3Na) until a drop of the solution after being well stirred gave an immediate blue colour with starch and

potassium iodide solution: 15 c.c. of the sodium nitrite solution were required. Hence, 97.5 per cent. of pure sodium azide was present in the sample.

The latter result is very probably the more accurate, as a small quantity of nitrous oxide is likely to remain in solution in the nitrometer method. It is intended to test the method more fully with some pure azides.

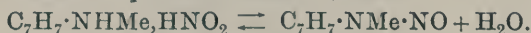
260. "Benzylmethyl-, benzylethyl-, and allyl-ammonium nitrites."
By Prafulla Chandra Rây and Rasik Lal Datta.

Benzylmethyllummonium nitrite has been obtained in solution only by the double decomposition between silver nitrite and the amine hydrochloride. During the process, minute drops of an oily liquid make their appearance and float on the surface. After the end-point is carefully attained, the solution is left to remain, when within a short time the oil increases considerably, and settles down in globules at the bottom of the vessel. The oil was found to be a nitroso-compound, and analysis proved it to be *benzylmethylnitroso-amine*.

Found: C=63.54; H=6.79; N=18.36.

$C_8H_{10}ON_2$ requires C=64.00; H=6.66; N=18.66 per cent.

The supernatant liquid was examined from time to time, and found to respond to the nitrite reaction. Evidently after the conversion of the greater portion of the nitrite into the nitroso-compound a process of equilibrium sets in, thus:

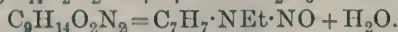
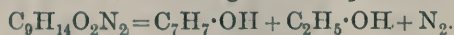


Benzylethylammonium nitrite has been obtained by the usual method as a pale yellow, crystalline substance.

Found: C=59.02; H=7.83; N=15.45.

$C_9H_{14}O_2N_2$ requires C=59.34; H=7.69; N=15.38 per cent.

The salt sublimes at 50—55° with simultaneous decomposition, although it begins to decompose slowly at the ordinary temperature (24°) in a vacuum. The sublimate consists of white, glistening crystals. The products of decomposition are nitrogen, a nitroso-compound, and alcohols, according to the equations:



Allylammonium nitrite prepared similarly is a brown, viscid liquid, having the characteristic odour of alkylammonium nitrites.

Found: C=34.82; H=8.05; N=27.15.

$C_3H_8O_2N_2$ requires C=34.62; H=7.69; N=26.92 per cent.

The salt decomposes in a vacuum into nitrogen and allyl alcohol.

261. "Note on the action of ethylene oxide on hydrazine hydrate."

By Edward de Barry Barnett.

When ethylene oxide is added to a large excess of well-cooled hydrazine hydrate, a brisk reaction takes place with evolution of heat. After distilling off the excess of hydrazine, an oily residue remains, from which two substances can be separated by repeated fractionation in a vacuum.

β-Hydroxyethylhydrazine, $\text{HO}\cdot\text{C}_2\text{H}_4\cdot\text{NH}\cdot\text{NH}_2$, is the main product of the reaction, and forms a colourless, very viscous oil, which boils at $119\text{--}120^\circ/9$ mm.:

0.2628 gave 0.3034 CO_2 and 0.2560 H_2O . $\text{C}=31.5$; $\text{H}=10.8$.

0.1378 „ 44.0 c.c. N_2 at 18° and 756 mm. $\text{N}=36.7$.

$\text{C}_2\text{H}_5\text{ON}_2$ requires $\text{C}=31.6$; $\text{H}=10.5$; $\text{N}=36.9$ per cent.

It at once combines with formaldehyde with evolution of heat to form a compound, $\text{C}_4\text{H}_8\text{ON}_2$, which crystallises from alcohol in colourless needles melting at 224° :

0.2058 gave 0.3610 CO_2 and 0.1556 H_2O . $\text{C}=47.8$; $\text{H}=8.4$.

0.1010 „ 23.8 c.c. N_2 at 15° and 762 mm. $\text{N}=27.7$.

$\text{C}_4\text{H}_8\text{ON}_2$ requires $\text{C}=48.0$; $\text{H}=8.0$; $\text{N}=28.0$ per cent.

Di-*β*-hydroxyethylhydrazine, $[\text{HO}\cdot\text{C}_2\text{H}_4\cdot\text{NH}\cdot]_2$ or
 $(\text{HO}\cdot\text{C}_2\text{H}_4)_2\text{N}\cdot\text{NH}_2$

(Found, $\text{C}=39.7$; $\text{H}=10.1$. Calc., $\text{C}=40.0$; $\text{H}=10.0$ per cent.), forms a colourless, very viscous syrup, which boils at $171^\circ/10$ mm. It is probably identical with the *as*-di-*β*-hydroxyethylhydrazine described by Knorr and Brownsdon (*Ber.*, 1902, **35**, 4474) as boiling at $188\text{--}190^\circ/25$ mm.

262. "Note on the hydrolysis of acetic anhydride."

By James Charles Philip.

In connexion with Orton and Jones's paper on this subject (*Trans.*, 1912, **101**, 1708), the results of some preliminary experiments made a few years ago in the author's laboratory were described.

The course of the reaction between acetic anhydride and water in glacial acetic acid solution was followed by determining the freezing point from time to time. As the anhydride and water progressively combine, the freezing point rises steadily until, when one or other of the two substances has disappeared, it reaches a constant value. If the acetic anhydride and water were taken in equivalent proportion, this final constant value would be the freezing point of absolute acetic acid.

In reality, the depressions recorded at successive intervals are not strictly comparable, for as the reaction proceeds the quantity

of solvent increases—by about 3 per cent. from beginning to end in the actual experiments. It would be quite possible to allow for this in evaluating the velocity-coefficient, but, in view of the preliminary character of the work, no correction was applied.

When a mixture of acetic acid, acetic anhydride, and water had been prepared, portions were transferred to tubes of special resistance glass, which were then sealed up and immersed for different periods in a water-bath kept at a constant temperature. Each tube, on being taken out of the bath, was rapidly cooled, and the freezing point of the contents was determined immediately.

The acetic acid used was obtained by repeatedly freezing out the pure commercial acid, and had a freezing point of 16.42° (corr.). It still contained a trace of water, the amount of which was determined by adding a slight excess of acetic anhydride, and heating samples of the mixture in sealed tubes until no further change in freezing point was observed; thus, in one estimation, 0.939 gram of pure anhydride was added to 68.154 grams of the acetic acid with freezing point 16.42° ; a sample of this mixture, heated at 100° for fifteen hours, showed a rise of 0.39° in freezing point; another sample, heated for thirty-two hours at 100° , showed a rise of 0.40° . Half the rise was due to the water, the amount of which was therefore 0.1 per cent.

The following table shows the results obtained in one case for the velocity of the reaction at 70.1° . The mixture made up contained 267.02 grams of acetic acid, 6.23 grams of anhydride, and 1.123 grams of water. In calculating the velocity-coefficient by the formula $0.4343k = \frac{1}{(a-b)t} \log \frac{b(a-x)}{a(b-x)}$, allowance has been made for the water present in the acetic acid.

<i>t</i> min.	F.-p. depression.	<i>k</i> .
0	1.550°	—
30	1.415	0.0033
60	1.290	0.0035
90	1.170	0.0037
160	0.970	0.0037
250	0.784	0.0038
360	0.653	0.0036
500	0.520	0.0037
600	0.446	0.0037
∞	0.115	—

In the experiment just recorded, water was in excess. Another similar experiment, carried out at the same temperature but with acetic anhydride in excess, gave the following values of *k* at somewhat similar intervals: 0.0032, 0.0034, 0.0034, 0.0035, 0.0035, 0.0036, 0.0037, 0.0037, 0.0037, 0.0036.

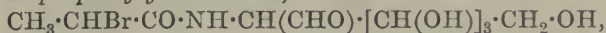
The mean value of *k* at 70.1° may therefore be taken as approxi-

mately 0.0036. From an experiment made at 80.5° a mean value of 0.0063 was obtained for k .

263. "Condensation of bromoacyl haloids with glucosamine (Preliminary note.)" By Arthur Hopwood and Charles Weizmann.

Bromoacyl haloids condense with glucosamine in cold alkaline solution, yielding bromoacylglucosamines.

α -Bromopropionylglucosamine,



is prepared by adding α -bromopropionyl bromide (1 mol.) and N -sodium hydroxide (1 mol.) gradually, and alternately with frequent shaking to a cold solution of glucosamine hydrochloride (1 mol.) in N -sodium hydroxide (1 mol.). A colourless precipitate separates out, which, after addition of hydrochloric acid in slight excess, is collected, washed with a little cold water, and dried in air on a porous plate. The product crystallises from hot absolute alcohol in prismatic needles, melting and decomposing at 200—201° when gently heated, and at 210—211° when quickly heated. The crystals are readily soluble in water or dilute alcohol, but are only sparingly soluble in absolute alcohol. They dissolve instantly in cold ammonia or alkali hydroxides.

α -Bromoisohexoylglucosamine,



is prepared by the condensation of α -bromoisohexoyl bromide (1 mol.) and glucosamine hydrochloride (1 mol.) in alkaline solution. It crystallises from absolute alcohol as a mixture of rhombic plates and prismatic needles, which melts when heated quickly at 178—181° with much decomposition. The crystals are moderately soluble in cold, and readily so in hot, water. They are sparingly soluble in cold, but readily so in hot, absolute alcohol. They dissolve slowly in cold ammonia or alkali hydroxides.

α -Bromolaurylglucosamine,



is prepared by condensing α -bromolauryl chloride (1 mol.) and glucosamine hydrochloride (1 mol.) in a slightly alkaline solution. It crystallises from absolute alcohol in rhombic plates, which melt and decompose at 183—186°. The crystals are insoluble in hot or cold water, and moderately soluble in hot absolute alcohol. They do not dissolve in dilute hydrochloric acid, which shows that the amino-group, and not the hydroxy-groups in glucosamine, has been attacked during the condensation. The crystals are also almost insoluble in cold ammonia or alkali hydroxides.

The bromoacylglucosamines reduce alkaline copper solutions,

yielding red cuprous oxide, or ammonio-silver nitrate solution giving a silver mirror. On treatment with cold ammonium hydroxide and subsequent evaporation to dryness under diminished pressure, they yield colourless, crystalline solids, probably *aminoacylglucosamines*.

264. "Note on the formation of tetrachlorophthalyl chloride by chlorination of tetrachlorophthalide." By William Hobson Mills and Walter Henry Watson.

In view of the paper "On Symmetrical and Asymmetrical Dicarboxylic Acid Chlorides," by E. Ott, which appears in the current number of the *Annalen* (1912, **392**, 245), the authors communicated this note on some experiments on the chlorination of tetrachlorophthalide, undertaken on account of their possible bearing on the constitution of the chlorides of the 1:2-dicarboxylic acids.

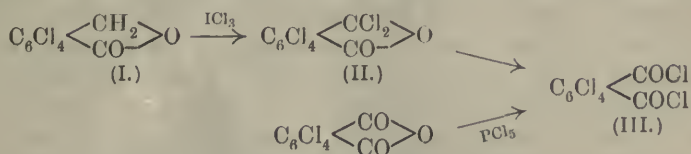
Tetrachlorophthalide, as would be expected, is very resistant to chlorination, but the displacement of the two atoms of hydrogen was effected by heating the phthalide (5 grams) with excess of iodine trichloride (10 grams) in a sealed tube for five hours to 150°. Iodine and iodine chlorides were then removed by warming under diminished pressure, and the product was purified as far as possible by crystallising first from carbon tetrachloride and then repeatedly from light petroleum, when it melted at 132–134°. That it had been formed from the phthalide by the displacement of the two hydrogen atoms by two atoms of chlorine was shown by the fact that on warming with sodium carbonate solution it was hydrolysed with the formation of tetrachlorophthalic acid, as well as by the analysis. (Found: reactive Cl=20·3; $C_8O_2Cl_4(Cl_2)$ requires reactive Cl=20·8 per cent.)

This product was identical with that obtained by the action of phosphorus pentachloride on tetrachlorophthalic anhydride, agreeing exactly in melting point,* general characters, and analysis. In particular, the mixed melting point showed no depression, and although a similar difficulty to that experienced by Ott (*loc. cit.*, p. 274) and by Brühl (*Annalen*, 1886, **235**, 13) was met with in obtaining either product quite free from acid anhydride, there was no doubt as to their identity.

In the light of Ott's discoveries, it is clear that the obvious conclusion that tetrachlorophthalyl chloride possesses the asym-

* The melting point 118° given by Graebe (*Annalen*, 1887, **238**, 328) is accordingly too low if the compound is not dimorphic.

metrical structure (II) (hexachlorophthalide) would not be legitimate:



It must rather be assumed that at the temperature at which the chlorination takes place, hexachlorophthalide undergoes transformation, and that the product obtained in both reactions is the symmetrical acid chloride (III).

265. "Note on the preparation and properties of sulphonic esters."

By John Ferns and Arthur Lapworth.

In a recent paper (*Trans.*, 1912, 101, 273) the authors described experiments showing that the reactions of sulphonic esters almost wholly depend on the nature of the alcohol from which the esters are derived. The behaviour of ethyl and methyl esters towards bases, and also towards sodium β -naphthoxide had been previously described, however (compare Ullmann and Werner, *Annalen*, 1903, 327, 120, and D.R.P. 112177), a fact which the authors regret they had overlooked.

The list of available methods for preparing sulphonic esters given in that paper was intended to be complete, but did not include one by Ullmann (*Annalen*, 1903, 327, 117), who showed that certain aromatic sulphonic acids may be converted into esters by treatment of their sodium salts with methyl sulphate.

In extension of the work described in the former paper, the authors have found that *p*-toluenesulphonyl chloride, dissolved in pyridine, converts many alcohols directly and smoothly into the corresponding unsaturated hydrocarbons, sulphonic esters being doubtless intermediate products; by the same process glycerol may partly be converted into acrolein. It is hoped to extend the observations to other hydroxy-compounds.

266. "Electromotive forces in alcohol. Part III. Further experiments with the hydrogen electrode in dry and moist alcoholic hydrogen chloride." By Robert Taylor Hardman and Arthur Lapworth.

The electromotive forces of a series of concentration cells reversible to hydrions have been measured at 25°, and the corresponding

values for the transport number of chloridion in absolute alcoholic hydrogen chloride were calculated with the aid of Nernst's equation. These values vary between 0.20 and 0.35, according to the concentration of hydrogen chloride, a result perhaps attributable to the inadequacy of the expression when applied to such electrolytes.

A re-examination of the influence of water on the potential of the hydrogen electrode in dilute alcoholic hydrogen chloride at 25° has been carried out with results similar to those recorded in Part II. (*Trans.*, 1911, **99**, 2250). The temperature-coefficients of the cells were also determined, and shown to be in fairly satisfactory agreement with the requirements of the solvate theory and with previous numerical data obtained from measurements on catalytic activity and availability.

267. "The properties of α -bromonaphthalene."

By John Ickeringill Crabtree and Arthur Lapworth.

The authors have prepared α -bromonaphthalene in a fairly high state of purity. It appears to be dimorphous, the ordinary modification melting at 6.20° and the second between 0.2° and 0.7°, although it is uncertain whether the latter has been obtained quite free from the former.

Several of the more important physical constants of the substance have been redetermined.

268. "Absorption spectra of the cobalto-derivatives of primary aliphatic nitroamines." By Antoine Paul Nicolas Franchimont and Hilmar Johannes Backer.

The cobalto-derivatives of primary aliphatic nitroamines, $\text{Co}(\text{NR}\cdot\text{NO}_2)_2$, have, both in aqueous solution and in the anhydrous state, an intensely purple-violet colour, differing from that of solutions of ordinary cobalt salts.

The cobalt derivatives of ethylnitroamine and propylnitroamine combine with two molecules of water, forming respectively yellowish-brown and bronze-green crystals; from methylnitroamine such a compound has not been obtained.

In order to gain objective data, the absorptive power for visible rays of the dissolved cobalt salts of methyl-, ethyl-, and propylnitroamine has been studied and compared with that of a cobalt nitrate solution.

The chief absorption band is found to be almost the same for the three cobaltonitroamines, but different from that shown by cobalt

nitrate. In addition, cobaltomethylnitroamine shows an absorption for smaller wave-lengths.

The conclusion is drawn that in cobaltonitroamines the metal is attached to the nitrogen atom.

269. "The constituents of *Cluytia similis*."

By Frank Tutin and Hubert William Bentley Clewer.

Cluytia similis, Muell. Arg., which is identical with the plant referred to by Smith ("A Contribution to South African Materia Medica," Cape Town, 1895, p. 57) as a smaller variety of *Cluytia hirsuta*, is reputed in South Africa to be of value as an antidote for anthrax and for the disinfection of "milt-ziek," or anthrax-infected meat. The root of this plant is also stated to be eaten by natives as an antidote for snake-bite poisoning. The entire above-ground portions, and also the root, of *C. similis* have therefore been submitted to chemical examination, when, in addition to chryso-phenol, fatty acids, and other known compounds, the following new substances were isolated: (i) *Cluytyl alcohol*, $C_{23}H_{58}O$ (m. p. 82.5°); (ii) *cluytinic acid*, $C_{21}H_{42}O_2$ (m. p. 69°); (iii) *cluytyl cluytinate*, $C_{49}H_{98}O_2$ (m. p. 76.5°); (iv) *cluytiasterol*, $C_{27}H_{44}O$ (m. p. 159°); (v) a new acid, $C_{10}H_{10}O_4$ (m. p. 159°); (vi) *cluytianol*, $C_{23}H_{37}O(OH)_3$ (m. p. $300-305^{\circ}$). Cluytianol is isomeric with the dihydric alcohol, ipuranol, which it resembles in its general properties. *Triacetyl-cluytianol* melts at 160° , and the *tribenzoyl* compound at 192° . The root also contained a quantity of inorganic matter, in which strontium was present.

270. "The constitution and reactions of thiocarbamides."

By Augustus Edward Dixon and John Taylor.

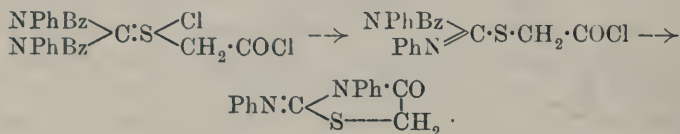
A consideration of the synthetic methods for producing "thiocarbamide," or its substitution derivatives containing univalent radicles, and of the properties displayed by these substances, leads the authors to conclude that, when in the static condition, they are all constituted on the type $NH_2 \cdot CS \cdot NH_2$.

By reaction with halogen compounds, RX (X =haloid), thiocarbamides generally yield products containing the nucleus of imino-thiocarbamic acid, $NH_2 \cdot C(NH) \cdot SH$, or "thiourea"; it does not follow, however, that the parent substances have the configuration of the latter, or acquire it through tautomeric change of a thiocarbamide, prior to interaction. In the authors' view, such phenomena are better explained as follows: The primary product is an additive compound of the type $\begin{matrix} NH_2 \\ | \\ NH_2 \end{matrix} > C : S < \begin{matrix} R \\ | \\ X \end{matrix}$; when from this the

elements of HX are withdrawn, the sulphur again becomes bivalent, the radicle, R, if alkyl, retaining its place, with formation of $\text{NH}_2\cdot\text{C}(\text{:NH})\cdot\text{SR}$, but if acyl, moving to the unsaturated nitrogen atom, to give a substituted thiocarbamide, $\text{RNH}\cdot\text{CS}\cdot\text{NH}_2$.

When the radicle, R, itself contains halogen or hydroxyl, the secondary product may undergo further change, with loss of halogen acid, or of water; in the former case, if the thiocarbamide contains an acyl radicle, this is eliminated preferentially to hydrogen.

s-Dibenzoyldiphenylthiocarbamide yields with chloroacetyl chloride, diphenylisothiohydantoin, $\text{PhN}:\text{C} \begin{smallmatrix} \text{NPh}\cdot\text{CO} \\ \text{S} \text{---} \text{CH}_2 \end{smallmatrix}$, and benzoyl chloride, the explanation, on the above lines, being as follows:



271. "The effect of heat on a mixture of benzaldehydecyanohydrin with *m*-chloroaniline and with *m*-toluidine." By Clement William Bailey and Hamilton McCombie.

The authors have extended the work described by Everest and McCombie (*Trans.*, 1911, **99**, 1752) by studying the effect of replacing aniline by substituted anilines.

When benzaldehydecyanohydrin and *o*-chloroaniline are heated together, even for several days, no condensation product could be obtained. In the case of *m*-chloroaniline, the products obtained were exactly analogous to those described by Everest and McCombie in the case of aniline itself, namely, (1) *m*-chloroanilinophenylacetoneitrile, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{NH}\cdot\text{CHPh}\cdot\text{CN}$; (2) *dibenzoyldi-m*-chloroanilinostilbene, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{NBz}\cdot\text{CPh}\cdot\text{CPh}\cdot\text{NBz}\cdot\text{C}_6\text{H}_4\text{Cl}$; (3) 1:5-diphenyl-3-*m*-chlorophenylglyoxaline, $\text{C}_{27}\text{H}_{19}\text{N}_2\text{Cl}$, and (4) α -keto- β -*m*-chloroanilino- $\alpha\beta$ -diphenylethane.

When *p*-chloroaniline was employed, the reaction took a different course. The product which was obtained gave figures in agreement with the formula $\text{C}_{35}\text{H}_{24}\text{O}_3\text{N}_2\text{Cl}_2$. The constitution to be assigned to this compound has not been determined, but it is hoped to return to this work later.

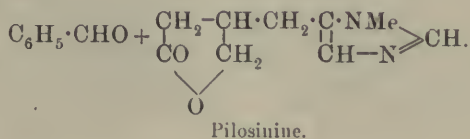
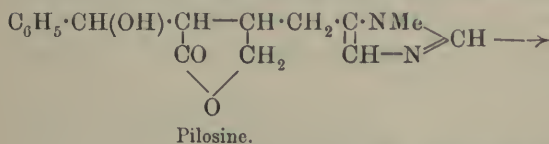
When the reaction was extended to the toluidines, results similar to those obtained in the case of the chloroanilines were obtained; thus, *o*-toluidine did not react with benzaldehydecyanohydrin, *m*-toluidine yielded products exactly analogous to those obtained

in the case of aniline and *m*-chloroaniline, whilst *p*-toluidine gave a substance of the formula $C_{37}H_{30}O_3N_2$.

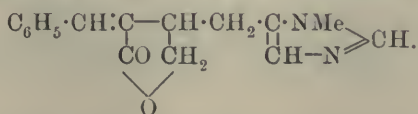
272. "Pilosine: a new alkaloid from *Pilocarpus microphyllus*."

By Frank Lee Pyman.

From the mother liquors remaining after the separation of pilocarpine and isopilocarpine from the total alkaloids of *Pilocarpus microphyllus*, a new alkaloid, *pilosine*, has been isolated in a yield amounting to 0.007 per cent. of the leaves. Pilosine has the empirical formula $C_{16}H_{18}O_3N_2$, and is a monacid base. It melts at 187° (corr.), and has $[\alpha]_D + 39.9^\circ$. It contains an *N*-methyl, but no methoxy-group. It also contains a lactonic grouping. On treatment with acetic anhydride it yields a new unsaturated base, *anhydropilosine*, $C_{16}H_{16}O_2N_2$, which melts at 133 – 134° (corr.), and has $[\alpha]_D + 66.2^\circ$. Pilosine is decomposed on distillation with 20 per cent. aqueous potassium hydroxide, benzaldehyde and a new base, *pilosinine*, $C_9H_{12}O_2N_2$, being formed. The chemical and physiological properties, as well as the solubilities of the latter base, are very similar to those of pilocarpine and isopilocarpine, and it seems probable that this base is a lower homologue of these alkaloids. Its formation from pilosine may then be represented as follows:



and anhydropilosine would then have the formula:



The physiological action of the three alkaloids is similar to, but very much weaker than that of pilocarpine.

273. "Note on the alkaloids of *Pilocarpus racemosus*."

By Hooper Albert Dickinson Jowett and Frank Lee Pyman.

The statements in the literature with regard to the amount and nature of the alkaloid contained in the leaves of *Pilocarpus racemosus* (Guadeloupe jaborandi) are conflicting.

Holmes (*Pharm. J.*, 1903, [iv], 17, 713) quoted the statement of G. Rocher, who examined the leaves in 1898-1899, that these contained 1 per cent. of total alkaloids, of which two-thirds was pilocarpine, but mentioned that another sample examined in the laboratories of Messrs. Wright, Layman, and Umney, Ltd., contained only 0.34 per cent. of total alkaloids.

Later, Holmes stated (*ibid.*, 1904, 18, 54) on the authority of A. J. Cownley, that the leaves of *P. racemosus* contained 0.6 per cent. of total alkaloids, which gave about 50 per cent. of a crystalline nitrate melting at 155°. Since pilocarpine nitrate melts at 178° and isopilocarpine nitrate at 159°, he considered that this nitrate probably consisted largely of isopilocarpine nitrate, or possibly of some other alkaloid.

Some time ago the authors examined a quantity of leaves of *P. racemosus* at the request of the Director of the Royal Gardens at Kew; on extracting the alkaloids and purifying them in the usual way, they obtained pure pilocarpine nitrate melting at 178° (corr.) in a yield amounting to 0.12 per cent. of the leaves, but no other crystalline products. This result confirms Rocher's statement that the leaves contain pilocarpine.

The mother liquors after the removal of pilocarpine gave a red coloration with sodium diazobenzene-*p*-sulphonate, indicating the presence of a base containing a free imino-group, and contained a small amount of bases sparingly soluble in water. The latter did not yield pilosine (compare the preceding abstract) when seeded with this alkaloid, and the quantity was insufficient to admit of further purification.

274. "The ignition of electrolytic gas by the electric discharge."

By Hubert Frank Coward, Charles Cooper, and Christopher Henry Warburton.

By suitable modifications in the usual apparatus for passing an electric discharge through a gaseous mixture, it has been found possible to ignite electrolytic gas ($2\text{H}_2 + \text{O}_2$) at pressures much lower than any previously recorded. A flame which filled a globe of 570 c.c. capacity has been produced at 5 mm. pressure, and one which travelled the whole length of a cylinder 2 metres long at

8 mm. In each case a small amount of gas remained uncombined. In two globes this residue varied in amount inversely as the original pressure of the gas, up to 70 mm. pressure.

275. "The relation between viscosity and chemical constitution. Part V. The viscosity of homologous series." By Albert Ernest Dunstan and Ferdinand Bernard Thole.

Having had two long homologous series placed at their disposal by Dr. Pickard, the authors have examined the viscosities of the different members therein. They have compared the various physical properties which have been measured for these series, namely, rotatory power, density, refractive power, and viscosity, and find that the strongly constitutive properties of optical rotatory power and viscosity give similar curves when plotted against molecular weight. Linear relationships are afforded by density, boiling point, refractive index, and $\log \eta$. The rotatory powers and viscosities rise to the third or fourth member, and then proceed normally.

276. "The relation between viscosity and chemical constitution. Part VI. Viscosity an additive function. By Albert Ernest Dunstan and Ferdinand Bernard Thole.

Attention was drawn to the linear relationship afforded by log viscosity in any homologous series. Using the data of Gartenmeister and Thorpe and Rodger, it was shown that group constants of $\log \eta$ may be obtained, from which molecular values may be calculated in good agreement with those observed.

Using this method for ethyl acetoacetate, it is found that 6.7 per cent. of the enolic form is present in the equilibrium mixture.

277. "The relation between viscosity and chemical constitution. Part VII. The effect of the relative position of two unsaturated groups on viscosity." By Albert Ernest Dunstan, Thomas Percy Hilditch, and Ferdinand Bernard Thole.

The authors have examined the viscosities of a number of homologous series of compounds of the respective types $R \cdot [CH_2]_n \cdot R$ and $Ph \cdot [CH_2]_n \cdot R$, where R is a varying unsaturated radicle.

In both series the general order of the molecular viscosity rises when R is varied in the order Cl , CO_2Et , NH_2 , and CN , and in addition the initial member, containing two chemically adjacent

unsaturated groups, has been found to possess an exalted molecular viscosity, as calculated from the expression $\frac{\eta \times 10^6}{\text{Mol. Vol.}}$.

In the symmetrical series $\text{R} \cdot [\text{CH}_2]_n \cdot \text{R}$, the members represented by $\text{R} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{R}$ possess an enhanced value for this expression, but this is not the case in the phenyl group of compounds.

In the latter group the anomaly of the initial member is in general very pronounced, and is followed by an equally well-marked depression in the case of the second member, the values thereafter rising somewhat rapidly; the relative positions of the curves connecting the molecular viscosities of the members of each homologous series, the relative slopes of these curves, and the extent of the depression at the second term are in the ascending order $\text{R} = \text{H}$, Cl , CO_2Et , NH_2 , CN , and OH .

The series examined afford undoubted evidence of the strong mutual influence of two unsaturated groups on viscosity, not only when the radicles concerned are adjacent in the molecule, but also when they may be supposed from common steric considerations to approach one another in space.

In addition, indications have been obtained of the varied influences exerted by combinations of two similar, and on the other hand of two dissimilar, radicles, the effects in the latter case depending to all appearance on the relative degree of unsaturation of the component radicles.

278. "Contributions to the chemistry of the terpenes. Part XIV. The oxidation of pinene with hydrogen peroxide." By George Gerald Henderson and Maggie Millen Jeffs Sutherland.

When pinene is oxidised with 30 per cent. aqueous hydrogen peroxide in presence of acetic acid, the chief product is α -terpineol, $\text{C}_{10}\text{H}_{17} \cdot \text{OH}$, partly free and partly as the acetate. The other neutral products of the reaction include borneol (as the acetate), a small quantity of dipentene, a trace of the aldehyde, $\text{C}_{10}\text{H}_{16}\text{O}$, formerly obtained by the oxidation of pinene with chromyl chloride, and some menthane-1:4:8-triol (1:4:8-trioxysterpan), $\text{C}_{10}\text{H}_{17}(\text{OH})_3$. The last compound has been obtained by oxidising $\Delta^{4(8)}$ -menthenol-1 with dilute permanganate, but has not hitherto been directly produced from pinene. Neither pinene glycol, pinol, nor any ketone was detected among the oxidation products, and only a trace of an oily acid, or mixture of acids, was obtained.

It is obvious that the behaviour of pinene towards hydrogen peroxide differs very considerably from that of camphene under similar conditions (Henderson and Sutherland, *Trans.*, 1911, **99**,

1539), and that in this case, as in many others, the action of the reagent leads to disruption of the dimethylcyclobutane ring in pinene, and to the formation of derivatives of isomeric terpenes.

279. "Baly and Krulla's hypothesis of fluorescence."

By Alexander Killen Macbeth.

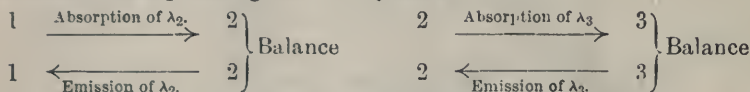
To be of ordinary utility and find general acceptance, a theory of fluorescence must necessarily differentiate between absorbing substances which fluoresce and those which do not. It must also lay stress on the variation in wave-length and the increase in duration of the emission when the substance is in the solid state. The recent hypothesis of fluorescence put forward by Baly and Krulla (*Trans.*, 1912, 101, 1469) offers no explanation of these points.

The basis on which their hypothesis is built is the assumption of different degrees of binding up of the secondary valencies of the constituent atoms of the molecule; thus a substance is capable of existing, first, in a state 1, in which maximum condensation of the force field has occurred; after that in states 2, 3, 4, . . . etc., representing various stages of "opening up." The change $1 \rightarrow 2$ is brought about by the selective absorption of light of wave-length λ_2 . By the influence of light of, say, wave-length λ_3 and a suitable solvent, the substance may be opened up into 3. Hence the reverse reaction $3 \rightarrow 2$ must be accompanied by an emission of light of wave-length λ_3 . If the substances 1, 2, 3, . . . are present, the change $2 \rightarrow 1$ must involve disturbance of the system $3 \rightarrow 2$; that is, in the bringing about again of the state 1, which has been disturbed by the absorption of light λ_2 , we must get the process $3 \rightarrow 2$, or emission of λ_3 also. Baly and Krulla further state that because of this, when 1 passes into 2 by the absorption of light of wave-length λ_2 , the change $3 \rightarrow 2$ is produced with the emission of light of wave-length λ_3 , the latter constituting the fluorescence. It does not seem reasonable to suppose such to be the case. If the substance can exist in the forms 1, 2, 3, . . ., it is justifiable, in the light of chemical theory, to assume that these forms are in the state of chemical equilibrium; thus, 1, 2, 3, . . . being intimately connected, the system can be represented as follows:

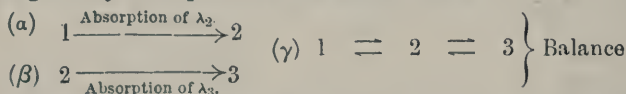


On Baly and Krulla's assumptions, the change $1 \rightarrow 2$ is accompanied by the absorption of light of wave-length λ_2 ; and the reverse change, $2 \rightarrow 1$, by an emission of the same light. Similarly, the changes $2 \rightarrow 3$ and $3 \rightarrow 2$ are accompanied respectively by absorption and emission of light of wave-length λ_3 . It is thus evident

that in equilibrium in solution there is a complete balance of light, as is seen on separating the two systems:



If, now, the whole system is supposed to be disturbed by an exciting light of wave-length λ_2 , effecting the change $1 \rightarrow 2$, according to the hypothesis, the equilibrium position will then be disturbed, and some of the process $2 \rightarrow 3$ will result. Later, equilibrium may be supposed to be again attained. The changes in this case are, first, an absorption of λ_2 , and secondly, an absorption of λ_3 ; and if equilibrium is then attained, there is a balance of light with, in addition, the preceding absorption effect. That is, the hypothesis leads to a further absorption of light, without any emission; thus, when the exciting light, λ_2 , is cast on the substance, the changes may be represented as shown below:



and the effect outstanding is clearly an absorption of λ_2 plus λ_3 .

Further, if the exciting light λ_2 is withdrawn, it is most reasonable to suppose that under suitable conditions the reverse reaction will commence, and there will be an emission of the original wavelengths which were absorbed, in agreement with Kirchhoff's law. This change may be represented thus: First, the system 3, 2 is involved, giving the process $3 \rightarrow 2$, with its attendant emission of λ_3 . This necessarily involves the process $2 \rightarrow 1$, giving emission of λ_2 , and, later, equilibrium is established between 1, 2, and 3. . . . The effect may be summarised thus:

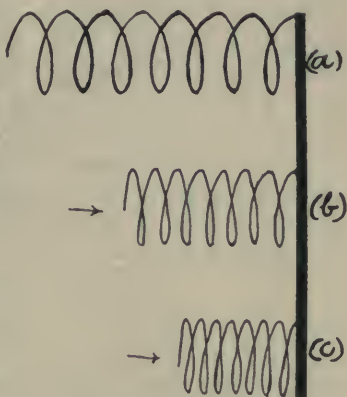


Thus the application of the hypothesis would not explain fluorescence; and it seems more capable of explaining phosphorescence, since, whilst the light was acting, the reaction would be driven in the direction $1 \rightarrow 2 \rightarrow 3$, the reverse change taking place under suitable conditions when the source of free energy is withdrawn. The system, in closing, would emit free energy in the form of light, and from the above considerations this light would be of a similar nature to that absorbed when the exciting source was in action. Examples in support of this are found in the cases of luminous paints and other phosphorescing substances. Moreover, it would appear from the behaviour of ammonium platinoeyanide

that the later stages may be isolated, as on cooling a crystal of this substance to the temperature of liquid hydrogen and exposing it to a strong light, no phosphorescence is noticed on removal to a dark room. On withdrawing the crystal from the chilled tube and allowing it to become warm, it presently emits light of great intensity. Fluorescence in this case is not shown until additional free energy enters the system in the form of heat, disturbing the molecular compound 3, 4, . . . n , and resulting in the re-formation of 1. A real difficulty, however, is met when one considers the case of substances which show no fluorescence at the ordinary temperature, and yet give strong emissions at low temperatures. At -180° , acetophenone, benzophenone, asparagine, hippuric, salicylic, and uric acids give brilliant fluorescence which they do not exhibit at the ordinary temperature. Here there are substances, at the ordinary temperature, containing free energy, and showing no fluorescence, which at low temperatures, when much of the free energy has been withdrawn, fluoresce strongly. This cannot be brought into agreement with the hypothesis of Baly and Krulla.

An analogy may be drawn between the hypothetical states 1, 2, 3 . . . n , and a spring fixed at one end. The first state 1 is denoted at (a), this being the state under ordinary conditions. When free energy is supplied to the spring (as light λ_2 is applied to the substance 1), there is absorption, and the spring is compressed to position (b), corresponding with the state 2. Further free energy will compress it to (c), corresponding with λ_3 , giving $2 \rightarrow 3$. Now the Baly-Krulla hypothesis states that $1 \rightarrow 2$, with absorption of λ_2 , involves the change $3 \rightarrow 2$ with the emission of λ_3 ; yet there is no apparent reason why compression from (a) to (b) should necessitate the change from (c) to (b), the more so since the state (c) has not been reached. Similarly, on the basis of the hypothesis, if 2 is produced solely by the absorption of λ_2 , then 3 cannot exist until 2 is passed, that is, until further absorption has taken place.

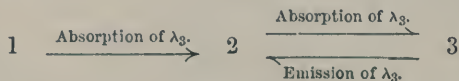
On these grounds it cannot be affirmed that an absorption of λ_2 develops an emission of λ_3 . An idea of phosphorescence in such cases can, however, be formed by this means. At any degree of compression of the spring, withdrawal of the free energy supply



(that is, pressure) is followed by an emission of the energy stored by the spring; and in the analogous case of light, this represents phosphorescence; but it cannot be taken as giving an account of the cases of acetophenone, etc., mentioned above.

Again, Nichols and Merritt (*Phys. Rev.*, 1904, June and July) have verified that the wave-length of the exciting light may vary over a very wide range, and still produce the same fluorescence spectrum. Applying this to the changes 1, 2, 3, etc., if the wave-length connecting the substances 1 and 2 can vary over a wide range, it seems most reasonable to deduce that the wave-lengths connecting 2 with 3 may also vary considerably. In other words, the fluorescence spectrum would vary widely, on the Baly-Krulla hypothesis, since this postulates that the latter wave-lengths constitute the fluorescence.

Moreover, Nichols and Merritt (*loc. cit.*) have shown, after careful investigation of the intensities of the fluorescence spectra of many substances, that even when the exciting source, λ_2 , is made up of a band of spectra, slightly towards the red side of the point of most intense fluorescence, the emitted light is still of good intensity. In this case the exciting source (λ_2) has been varied, not only up to λ_3 , but beyond this wave-length. The particular case $\lambda_2 = \lambda_3$ may be taken. On the Baly-Krulla hypothesis, this may be written:



and it is hard to see what, in such a case, causes an emission of λ_3 .

The hypothesis can be regarded from yet another point of view. If it is true that an absorption of λ_2 takes place in the process $1 \rightarrow 2$, and a simultaneous emission of λ_3 in the process $3 \rightarrow 2$, the conclusion is inevitable that the amount of light absorbed differs when a substance is fluorescing and when it is in darkness. This is contrary to the facts observed and recorded by Wood (*Phil. Mag.*, 1908, [vi], 16, 940), who established the identical nature of the absorptions in these cases.

Seeing that the consideration of this hypothesis leads to no clear conception of the special cases of absorbing substances which show fluorescence, offers no explanation of the change of wave-length and duration of the emission when the substance is in the solid state, does not meet the case of substances exhibiting fluorescence as solids and yet showing no traces of the phenomenon when dissolved (for example, barium platinocyanide), and does not increase our knowledge of even the simplest facts in connexion with the phenomenon, it cannot be regarded as a rational theory of fluorescence.

280. "Hydrazoximes of benzil and diacetyl."

By Martin Onslow Forster and Biman Bihari Dey.

Unsubstituted hydrazoximes do not appear to have been studied; accordingly, *benzilhydrazoxime*, $C_{14}H_{13}ON_3$, and *diacetylhydrazoxime*, $C_4H_9ON_3$, were prepared, together with their acyl derivatives and products of condensation with benzaldehyde and acetone.

281. "The relation between constitution and rotatory power amongst derivatives of tetrahydroquinaldine." By William Jackson Pope and Thomas Field Winmill.

The authors have prepared a number of derivatives of *l*-tetrahydroquinaldine, and have shown that a close relation is observable between the molecular composition and constitution and the rotation constants of these substances.

282. "The dehydration of *iso*- β -naphthol sulphide."

By Kenneth Ross and Samuel Smiles.

When heated with certain dehydrating agents the unstable sulphide of β -naphthol loses the elements of water, giving an *isonaphthathioxin* (m. p. 148°). It has already been shown that the stable or normal sulphide also yields a naphthathioxin (m. p. 166°) with these reagents. With nitric acid (D 1.4) the *iso*-derivative furnishes the oily nitrate of the sulphoxide, from which the solid base may be liberated by hydrolysis. This sulphoxide is attacked by warm hydrochloric acid, giving a mixture of chloro-derivatives of the naphthathioxin. If the reaction is carried out under suitable conditions, the chief constituent of the crude product is identical with the dichloro-derivative previously obtained (Christopher and Smiles, *Trans.*, 1912, 101, 710) by chlorinating the monochloronaphthathioxin which is formed by the interaction of acetyl chloride and β -naphthasulphonium-quinone.

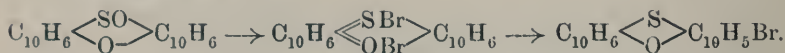
The naphthathioxin derived from the stable sulphide of β -naphthol undergoes a precisely similar series of changes; but the sulphoxide and chloro-derivatives are quite distinct from those of the *iso*-series.

The relations between these series are being examined, and will be discussed in connexion with the nature of the two sulphides of β -naphthol.

283. "Salts of naphthathioxonium." (Preliminary note.)

By Thomas Joseph Nolan and Samuel Smiles.

Previous attempts to obtain the thioxonium chloride by interaction of hydrogen chloride and oxides of naphthathioxins have uniformly resulted (*Trans.*, 1912, **101**, 710) in the immediate production of chloro-derivatives of the nucleus, the thioxonium salt being apparently too unstable in presence of excess of this mineral acid to permit isolation. It has, however, been observed (*Trans.*, 1910, **97**, 1112) that phenazothionium bromide reacts very sluggishly with hydrogen bromide, whereas the corresponding chloro-derivatives are very reactive. Taking advantage of this observation, it has been found that the thioxonium bromides may be obtained from the naphthathioxin oxides by treatment with luke-warm hydrobromic acid. They are slowly converted by the boiling reagent into the bromonaphthathioxins; the successive changes may be represented as follows:



These thioxonium bromides are more easily obtained by the interaction of bromine and β -naphthasulphonium-quinone in acetic anhydride or with the acetyl derivative of the unstable sulphide of β -naphthol in the same solvent.

284. "Intramolecular rearrangements of *o*-sulphoxides of diphenylamine. Part IV." By Thomas Percy Hilditch and Samuel Smiles.

Previous experiments (*Trans.*, 1911, **99**, 145) have shown that the *o*-sulphoxide of diphenylmethane when treated with hydrogen chloride or hot glacial acetic acid yields thioxanthanyl chloride or thioxanthanol. Attempts have now been made to isolate similar derivatives from the products of rearrangement of the *o*-sulphoxides of diphenylamine; but they were not successful. It was shown, for example, that diphenylamine *o*-sulphoxide yields hydroxythiodiphenylamine when heated with acetic acid, whilst the tetrachloro-derivative furnished the phenazothionium hydroxide. Similar attempts to obtain the *N*-chloro-derivative from the tetranitro- and tetrachloro-sulphoxides were unsuccessful.

285. "Diphenyl-2:3:2':3'-tetracarboxylic acid." (Preliminary note.)
By James Kenner.

Dimethyl 3-iodophthalate, $C_6H_3I(CO_2Me)_2$, forms prisms, m. p. 89° , and is converted by treatment with copper powder into *tetramethyl diphenyl-2:3:2':3'-tetracarboxylate*, $C_{12}H_6(CO_2Me)_4$, which forms needles melting at 161° .

Diphenyl-2:3:2':3'-tetracarboxylic acid, $C_{12}H_6(CO_2H)_4$, crystallises in plates melting at 265° , and is readily soluble in water.

The reactions of this compound are being investigated in connexion with the author's studies on ring-formation from derivatives of 2:2'-ditolyl.

286. "The reactions of dibenzocycloheptadienone." (Preliminary note.) By James Kenner and Emily Gertrude Turner.

In connexion with the authors' investigations of derivatives of 2:2'-ditolyl (*Trans.*, 1911, **99**, 2101), a comparison of the reactions of dibenzocycloheptadienone with those of β -hydrindone has been undertaken.

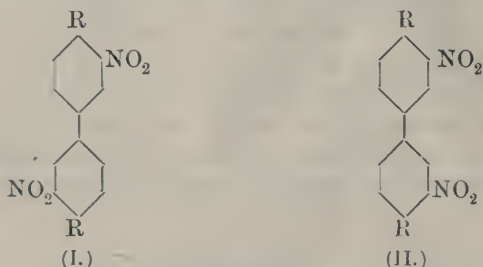
Unlike β -hydrindone, dibenzocycloheptadienone does not undergo condensation in the presence of alkali, and it yields a *dibenzylidene* derivative, m. p. 227° . Further, whilst β -hydrindone is known to yield a diisonitroso-derivative (from which, by the action of formaldehyde and hydrochloric acid, the authors have prepared triketohydrindene hydrate), dibenzocycloheptadienone only gives rise to a *monoisnitroso*-derivative, m. p. 197° . With aniline, β -hydrindone yields the normal condensation product (leaflets, m. p. 97°), but the action of aniline on dibenzocycloheptadienone leads to the formation of phenylcarbylamine and a *compound*, golden-yellow prisms, m. p. 188° , the constitution of which has not yet been ascertained.

Other reactions of the two ketones are under investigation.

287. "Studies in the diphenyl series. Part II. The dinitrobenzidines: a new form of isomerism." By John Cannell Cain, Albert Coulthard, and Frances Mary Gore Micklethwait.

It has hitherto been assumed that the same *o*-dinitrobenzidine is obtained by the nitration of diacetyl- and diphtalyl-benzidine. It is now found that two different *o*-dinitrobenzidines are produced in these reactions. That from diacetylbenzidine melts at 275° , gives a diacetyl derivative melting at 310° , and a dinitrodiphenyl melting at 197 – 198° (Brunner and Witt, *Ber.*, 1887, **20**, 1023), whilst that from diphtalylbenzidine melts at 233° , gives a diacetyl derivative

melting at 222° , and a *dinitrodiphenyl* melting at 110° . It was suggested that the series of compounds of higher melting points have the symmetrical (I) and those of lower melting points the unsymmetrical (II) constitution ($R=H, NH_2$, or $NHAc$):



Bandrowski's "*isodinitrobenzidine*" (*Ber.*, 1884, **17**, 1181; *Monatsh.*, 1887, **8**, 472) has been found to be a mixture of 2:2'-dinitrobenzidine and 3:3'-dinitrobenzidine (m. p. 233°) with a small amount of 3-nitrobenzidine.

288. "The velocity of reaction between potassium chloroacetate and some aliphatic amines." By Tom Sidney Moore, Donald Bradley Somervell, and John Newton Derry.

The rates of reaction of potassium chloroacetate with ammonia, the three methylamines, the three ethylamines, and dipropylamine in aqueous solution at 25° have been measured, and the velocity constants calculated from the measurements have been compared with those found by Menshutkin for the reactions of the same bases with methyl, ethyl, propyl, and allyl bromides.

289. "The absence of optical activity in the α - and β -2:5-dimethylpiperazines." By William Jackson Pope and John Read.

The authors have been unable to effect the resolution of either α - or β -2:5-dimethylpiperazine into optically active components by crystallisation with optically active acids or by condensation with *d*-oxymethylenecamphor.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Accum, Fredrick. A treatise on adulterations of food, and culinary poisons, exhibiting the fraudulent sophistications . . . and methods of detecting them. London 1820. pp. xvi + 372. (*Reference.*)

From Dr. Alexander Scott, F.R.S.

Armstrong, Edward Frankland. The simple carbohydrates and the glucosides. 2nd edition. London 1912. pp. viii + 171. 5s. net. (*Recd.* 25/9/12.)

From the Publishers : Messrs. Longmans, Green and Co.

Arrhenius, Svante. Theories of solutions. New Haven 1912. pp. xx + 247. 12s. 6d. net. (*Recd.* 19/9/12.)

From the Publishers : Oxford University Press.

Bolton, Edward Richards, and Revis, Cecil. Fatty foods, their practical examination. A handbook for the use of analytical and technical chemists. London [1912]. pp. x + 371. ill. 10s. 6d. net. (*Recd.* 4/11/12).

From the Publishers : Messrs. J. & A. Churchill.

Cathcart, E. P. The physiology of protein metabolism. London 1912. pp. viii + 142. 4s. 6d. net. (*Recd.* 14/10/12.)

From the Publishers : Messrs. Longmans, Green and Co.

Chapman, Alfred Chaston. Brewing. Cambridge 1912. pp. xii + 130. ill. 1s. net. (*Recd.* 11/10/12.)

From the Author.

Dakin, Henry Drysdale. Oxidations and reductions in the animal body. London 1912. pp. viii + 135. 4s. net. (*Recd.* 27/10/12.)

From the Publishers : Messrs. Longmans, Green and Co.

Harris, Frank. Gravitation. London 1912. pp. xi + 107. ill. 2/6 net. (*Recd.* 17/9/12.)

From the Publishers : Messrs. Longmans, Green and Co.

Martin, Geoffrey. Triumphs and wonders of modern chemistry. London [1912]. 7/6 net. pp. xvii + 358. ill. (*Recd.* 26/8/19.)

From the Author.

Martindale, William Harrison, and Westcott, W. Wyn. The Extra Pharmacopœia. 15th edition. London 1912. 2 vols. pp. xxxi + 1114, viii + 370. 21/- net. (*Recd.* 31/7/12.)

From the Authors.

Michelson, A. A. Light waves and their uses. Chicago [1903]. pp. vi + 166. ill. (*Recd.* 25/7/12.)

From the University of Chicago.

Pepper, John Henry. The Boy's Playbook of Science. Rewritten by John Mastin. London [1912]. pp. ix + 680. ill. 5s. (*Recd.* 2/10/12.)

From Dr. John Mastin.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 2nd, 1912.

All persons who received grants in December, 1911, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Monday, December 2nd.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Scientific Meeting on **Thursday, November 21st, 1912, at 8.30 p.m.**, the following papers will be communicated :

"The change in the boiling points of the trioxide and tetroxide of nitrogen on drying." By H. B. Baker and M. Baker.

"The tendency of atomic weights to approximate to integral and semi-integral values." By E. Feilmann.

"The constituents of Taraxacum root." By F. B. Power and H. Browning, jun.

"The condensation of α -keto- β -anilino- $\alpha\beta$ -diphenylethane and its homologues with phenylcarbimide and with phenylthiocarbimide." By S. A. Brazier and H. McCombie.

"Neutral salt action. Part II. The influence of sodium salts of organic acids on the rate of hydrolysis by alkali." By G. Senter and F. Bulle.

"The constitution of aconitine." (Preliminary note.) By O. L. Brady.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 28.

No. 406

Thursday, November 21st, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society, through death on November 9th, of Professor John William Mallet, LL.D., F.R.S., of the University of Virginia, who was elected a Fellow on December 15th, 1857, and an Honorary and Foreign Member on March 2nd, 1911.

Certificates were read for the first time in favour of Messrs.:

Neil Kensington Adam, 21, Barton Road, Cambridge.

Crellyn Colgrave Bissett, B.Sc., B.Met., 10, Claremont Place, Sheffield.

Daniel James Davies, B.Sc., 177, Le Marchant Road, St. John's, Newfoundland.

James Henry Edmondson, Newcroft, Urmston, Manchester.

Ulick Richardson Evans, The Kier, The Common, Wimbledon.

Alfred Leslie Howells, Bank Field, New Mill Road, Holmfirth.

Peter Thomas Leitch, c/o John Edgar, Esq., 176, West George Street, Glasgow.

Thomas Joseph Nolan, M.Sc., 32, Newmarket, Dublin.

Cornelius Theodore Pollard, B.Sc., 21, Wharncliffe Road, Broomhall Park, Sheffield.

Siddons Siddons Wilson, 154, Burges Road, East Ham, E.

Bertrand Turner, B.Sc., 55, Golden Hillock Road, Birmingham.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

James Crawford Douglas, Christmas Island, Straits Settlements.
 Frederick Lyle Grützmacher, Technical College, Rockhampton, Queensland.

Max Hilbert, Hamburg, Germany.

Tanjore S. Natrajan, Bikshandarkoil P.O., Srirangam, Trichinopoly.

Carl Alfred Nowak, B.Sc., 2739, Mildred Avenue, Chicago, Ill., U.S.A.

Of the following papers, those marked * were read:

***290. "The change in the boiling points of the trioxide and tetroxide of nitrogen on drying." By Herbert Brereton Baker and Muriel Baker.**

As a result of a private communication from Prof. A. Smith as to the volatility of dried calomel, the authors found, on consulting their notebook containing the description of the experiments on the vapour density of dried nitrogen trioxide (*Trans.*, 1907, **91**, 1862), two instances in which the liquid had failed to boil rapidly at 15° . A specimen of the liquid had fortunately been kept, which had been allowed to remain over phosphoric oxide for three years. This was sealed off in bulbs by immersing the whole in liquid air, and two of these were placed in tubes containing nitrogen, dried by contact with phosphoric oxide. After six months' keeping the bulbs were broken, and the boiling point of the liquid at atmospheric pressure (757 mm.) was found to be 43° , instead of -2° , which is the boiling point of the ordinary liquid. On cooling the tube to $+10^{\circ}$, green drops formed at once, showing that undissociated nitrogen trioxide was present. When a small quantity of nitrogen, dried by passing through a long column of phosphoric oxide, was admitted to the apparatus, the very small quantity of moisture which it contained produced vigorous dissociation, and the expansion blew out the stopper. It has also been found that dried nitrogen tetroxide could be kept at a temperature of $+69^{\circ}$ without boiling. The ordinary boiling point of this liquid is $+22^{\circ}$. Further experiments on the boiling points of dissociable substances are in progress.

*291. "The tendency of atomic weights to approximate to integral and semi-integral values." By Ernest Feilmann.

The fact that the atomic weights of the elements so often approximate to integral values, when measured in terms of the usual units, must strike any observer, and has indeed given rise to many speculations on the nature of the elements themselves.

The present communication deals with the relations between the deviations of the atomic weights from integral values, on the one hand, and the number of elements exhibiting such deviations on the other.

The atomic weights of the international table for 1913 were rounded off to the nearest tenth of a unit, and then sorted into ten groups according to the magnitude of the decimal portion of the figures so obtained. Where the figure in the table was exactly midway between two values, that is, where the second decimal place had the value 5, the corresponding element was considered to be shared by the two adjacent groups, each of which was credited with half a unit.

The groups were:

0·0. As, Bi, B, C, Cr, Co, Eu, F, He, H, La, Lu, Mo, N, O, P, Na, Sn, Tl, V, Yb, Yt, W—23 elements.

0·1. Al, Ca, Gl, Ir, Pb, K, Sc, S, Ti—9 elements.

0·2. Sb, Au, Ne, Pt, Se, Tb, Xe, and Ce (half)—7·5 elements.

0·3. Gd, Mg, Nd, Si, and Ce (half)—4·5 elements.

0·4. Ba, Cd, Nt, Ra, Sa, Th, Zn, and Rb (half)—7·5 elements.

0·5. Cl, Cb, Dy, Ge, Ho, Ta, Te, Tn, U, and Rb (half)—9·5 elements.

0·6. Cu, Hg, Pr, Sr, Zr—5 elements.

0·7. Er, Ni, Pd, Ru—4 elements.

0·8. Cs, In, Fe—3 elements.

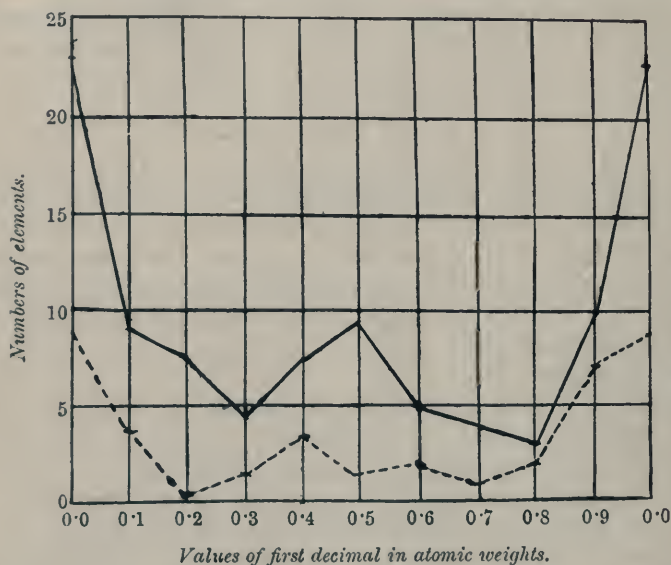
0·9. A, Br, Ga, I, Kr, Li, Mn, Os, Rh, Ag—10 elements.

Thus we have the following table:

Value of decimal	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9
Number of elements..	23	9	7·5	4·5	7·5	9·5	5	4	3	10

From this table the upper curve (continuous line) in the figure is plotted. The symmetry of this curve is remarkable, considering how many gaps still remain in the periodic table of the elements and other irregularities, such as errors in the atomic-weight determinations of the less known elements. The other obvious characters of the curve are, first, the very marked rise as integral values are approached, and secondly, the smaller maximum in the neighbourhood of 0·5.

Although all the figures given in the atomic-weight table might be supposed to be significant, it was thought advisable to plot a further curve, using those atomic weights only which are given in the table to two or more significant decimals, as it is possible that the large number of atomic weights in the 0.0 column may be really due, to some extent, to the fact that, for the less known elements these are known only to within about one unit, and that



the 0.0 in these cases is really meaningless. We thus obtain the groups:

0.0. As, C, Co, He, H, N, O, P, Na—9 elements.

0.1. Ca, Pb, K, S—4 elements.

0.2. Ce (half)—0.5 elements.

0.3. Mg, Ce (half)—1.5 elements.

0.4. Ba, Cd, Zn, Rb (half)—3.5 elements.

0.5. Cl, Rb (half)—1.5 elements.

0.6. Cu, Sr—2 elements.

0.7. Ni—1 element.

0.8. Cs, Fe—2 elements.

0.9. A, Br, I, Li, Mn, Ag, Kr—7 elements.

From these figures the lower (dotted) curve is obtained.

Considering that the atomic weights of thirty-two elements only are known with sufficient accuracy to be used for this second curve, its general form agrees very well with that of the first curve; there

is the same well-marked rise as integral values are approached, and the intermediate maximum is also well marked, although it coincides with the value 0.4 instead of with 0.5. This fact may, however, well be due to the comparative lack of data.

It appears from the above considerations that there is a marked tendency for atomic weights to approximate to values which are multiples of unity, or, to a less degree, of 0.5, when the present unit, that is one-sixteenth of the atom of oxygen, is used; when the older standard, namely, the atom of hydrogen, is used as unit these relations no longer hold good.

***292. "The constituents of taraxacum root."**

By Frederick Belding Power and Henry Browning, jun.

The material employed for this investigation consisted of the air-dried fresh roots of taraxacum (*Taraxacum officinale*, Wiggers), collected in the autumn from plants grown in England.

The root was found to contain an enzyme which slowly hydrolysed amygdalin, and an alcoholic extract of the root, when distilled with steam, yielded a small amount of a yellow essential oil.

From the portion of the alcoholic extract which was soluble in water the following compounds were isolated: (i) *p*-hydroxyphenylacetic acid, $C_8H_8O_3$; (ii) 3:4-dihydroxycinnamic acid, $C_9H_8O_4$; and (iii) choline, $C_5H_{15}O_2N$. The aqueous liquid also contained a quantity of sugar, which apparently consisted chiefly of lævulose.

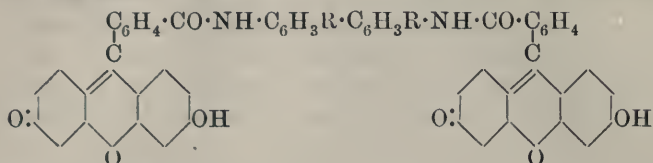
The portion of the alcoholic extract which was insoluble in water consisted of a soft, oily resin, amounting to 1.8 per cent. of the weight of the root. From this material the following compounds were obtained: (i) Two new monohydric alcohols, *taraxasterol*, $C_{20}H_{47}\cdot OH$, and *homotaraxasterol*, $C_{25}H_{50}\cdot OH$, from which several derivatives were prepared; (ii) cluytanol, $C_{20}H_{46}O(OH)_4$; and (iii) palmitic, cerotic, and melissic acids, together with a mixture of unsaturated acids consisting chiefly of oleic and linolic acids.

The so-called "taraxacin" and "taraxacerin" of earlier investigators are regarded as indefinite mixtures.

***293. "Studies in the diphenyl series. Part III. Diphenyldiphthalamic acids and pyronine colouring matters containing the diphenyl group." By John Cannell Cain and Oscar Lisle Brady.**

Diphthalamic acids of benzidine, tolidine, and dianisidine are produced by the interaction of phthalic anhydride and the diamine at 100° in the presence of nitrobenzene. They condense with

resorcinol in the presence of zinc chloride to give colouring matters of the formula:



(where R = H, Me, or OMe).

These colouring matters are also obtained by heating a mixture of (i) the diamine, phthalic anhydride, and resorcinol with zinc chloride; (ii) fluorescein, the diamine, and the hydrochloride of the diamine; and (iii) the diphtalimino-derivative of the diamine with resorcinol and zinc chloride.

On bromination they yield octabromo-derivatives which can also be obtained by heating eosin with the diamine and the hydrochloride of the diamine.

The reaction appears to be a general one, as it takes place when di- and tetra-chlorophthalic or succinic anhydrides are used instead of phthalic anhydride, and when diethyl-*m*-aminophenol is substituted for resorcinol. Condensation takes place also with quinol, catechol, and pyrogallol, but in these cases the colouring matters produced are brown, and probably have a constitution different from the above.

DISCUSSION.

Dr. J. T. HEWITT drew attention to the interesting difference existing between the compound obtained by the authors and fluoresceinamide. The latter was a colourless substance, and probably had a lactam constitution.

*294. "Viscosity and association. Part III. The existence of racemic compounds in the liquid state." By Ferdinand Bernard Thole.

The application of the viscometric method to the solution of the problem of the existence of racemic compounds in the liquid state has been extended to a much wider range of substances, both in solution and in the fused state.

The results obtained for viscosity and other physical properties have also been correlated.

In the present work the results obtained show that the majority of *dl*-liquids and solutions are merely conglomerates. Under this heading fall *ac*-tetrahydronaphthol, heptan- β -ol, octan- β -ol, carv-oxime, octyl hydrogen phthalate, and ethyl mandelate.

On the other hand, distinct evidence of the existence of a liquid racemate has been found with dimethyl and diethyl racemates and *l*-menthyl *r*-mandelate. To these may be added the cases of racemic acid and perhaps *r*-mandelic acid previously investigated.

In the cases where racemate existence in solution has been substantiated dissociation is very considerable, and increases with increasing dilution of the solution.

The degree of dissociation at a given concentration and the rate of dissociation with dilution depend on the nature of the solute and the solvent, a condition which is paralleled by the ionic dissociation of salts dissolved in various solvents.

DISCUSSION.

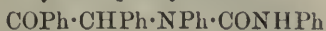
Mr. THOLE agreed with the President that tartaric acid and its esters were undoubtedly associated, and that the degree of association would be influenced by racemate formation.

This point had, in fact, been brought out in a previous communication on this subject.

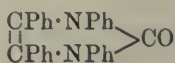
In reply to Dr. McKenzie's question as to the identity of solutions prepared from racemic acid and from equal quantities of the enantiomorphs, the author stated that this point had been tested and the identity of the solutions established. The menthyl mandelates had been investigated, both in the fused state and in solution in amyl acetate. Although this liquid was one of the least dissociating solvents, dissociation of the racemic solute was very considerable, and probably in dissociating solvents such as alcohol or water dissociation would be practically complete.

295. "The condensation of α -keto- β -anilino- $\alpha\beta$ -diphenylethane and its homologues with phenylcarbimide and with phenylthiocarbimide." By Sidney Albert Brazier and Hamilton McCombie.

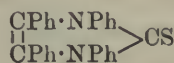
α -Keto- β -anilino- $\alpha\beta$ -diphenylethane and phenylcarbimide when heated together yield *desyl-s-diphenylcarbamide* (I). This compound, on treatment with alcoholic hydrogen chloride, loses the elements of water, yielding 1:3:4:5-tetraphenyl-2:3-dihydro-2-glyoxalone (II). The reaction has been extended also to the compounds in which aniline has been replaced by *o*-, *m*-, and *p*-toluidine, and by β -naphthylamine:



(I.)



(II.)



(III.)

The phenylcarbimide has also been replaced by phenylthiocarb-

imide, resulting in the production of 1:3:4:5-*tetraphenyl-2:3-dihydro-2-glyoxalthione* (III) and its homologues.

The glyoxalones and the glyoxalthiones were found to be very stable substances, unaffected by acids, alkalis, or phosphorus pentachloride.

The glyoxalones yield salts with picric acid, but not with hydrochloric acid. These picrates can be divided into two classes, namely, (1) those formed by the aniline, *p*-toluidine, and β -naphthylamine compounds are red, and consist of two molecules of the base combined with one molecule of picric acid; and (2) those formed by the *o*- and *m*-toluidine compounds are yellow, and consist of the base and picric acid in equimolecular proportions.

296. "The influence of the sodium salts of organic acids on the rate of hydrolysis by alkali." By George Senter and Fritz Bulle.

The main results of the investigation are as follows:

(1) Sodium salts of organic acids, like the corresponding salts of inorganic acids, have only a slight effect on the rate of hydrolysis of ethyl acetate in alkaline solution.

(2) Sodium salts of organic acids accelerate the hydrolysis of sodium bromoacetate by alkali to a still greater extent than do the salts of inorganic acids.

(3) This effect has been traced, taking the case of sodium acetate as typical, to the intermediate formation of esters of sodium glycollate (for example, sodium acetylglycollate), which are hydrolysed by alkali as fast as they are formed.

(4) From the extent to which the hydrolysis of ethyl acetate by alkali is retarded by monosodium salicylate, a provisional estimate of the second acid dissociation-constant of salicylic acid at 20° has been made.

297. "Photo-kinetics of sodium hypochlorite solutions."

By William Cudmore McCullagh Lewis.

Aqueous solutions of sodium hypochlorite, both neutral and alkaline, are photochemically decomposed, the principal products of decomposition being sodium chloride and oxygen. This reaction cannot be brought about with measurable velocity by heat rays alone, the active region being the blue-violet end of the visible spectrum and the ultraviolet region. By means of suitably coloured filters it is possible to reduce the velocity of decomposition to zero. Since the photochemical decomposition is in the same direction as

that followed, although very slowly, in the dark, the effect of the light is a catalytic one. The reaction proceeds completely after sufficient exposures, no measurable equilibrium point being obtained.

298. "The constitution of aconitine." (Preliminary note.)

By Oscar Lisle Brady.

On treating aconitine with concentrated nitric acid a vigorous action takes place, and from the reaction mixture a compound can be obtained, which crystallises readily from alcohol, and melts and decomposes at 200—205°.

This compound gives a strong nitroso-reaction; the solution in aqueous potassium hydroxide, on warming, becomes brown, and the substance cannot be reprecipitated with acids. By distillation with potassium hydroxide, dimethylamine was obtained. From the mother liquor, after acidifying, acetic and benzoic acids were isolated, indicating that the benzoyl and acetyl groups of the aconitine remain in this compound. The substance is a carboxylic acid, and forms a silver salt; this is, however, unstable, and deflagrates on heating, and attempts to determine its molecular weight have given very discordant results. The following results were obtained on analysis: C=53.8; H=5.5; N=5.8; OMe=12.4 per cent.

So far as can be judged, this compound is a simple benzenoid substance containing at least one methoxy- and one carboxyl group, and the dimethylamino-, nitroso-, acetyl, and benzoyl groups.

An aqueous solution of chromic acid precipitates from an acid solution of aconitine an insoluble *dichromate*, $C_{34}H_{47}O_{11}N, H_2Cr_2O_7$. This substance on warming with dilute sulphuric acid gives a viscid mass, which was not further investigated. By the action of potassium permanganate in acid solution a crystalline substance is obtained, which is identical with that to which Carr (this vol., p. 253) has given the name oxonitin. The author's analytical results (Found, C=59.5, 59.9; H=6.4, 6.4; OMe=18.2 per cent.) and molecular-weight determination by the ebullioscopic method in chloroform (431) agree well with the formula, $C_{23}H_{29}O_9N$, assigned to this substance; other properties, such as solubility and melting point, also agree.

The suggestion that the substance is a carboxylic acid seems unlikely in view that it is insoluble in cold alkalis; it seems probable that the compound is a ketone or an aldehyde, as there is some indication of the formation of a semicarbazone, but the preparation is rendered difficult owing to the insolubility of the

compound. This substance has also been obtained in much better yield by the action of potassium permanganate in neutral solution.

From the mother liquors after separation of oxonitin a crystalline *bromo*-compound was obtained melting above 300°. (Found, C=40·9; H=5·4 per cent.)

299. "Properties of mixtures of ethyl alcohol, carbon tetrachloride, and water." By Thomas Henry Hill.

Ethyl alcohol and carbon tetrachloride give a mixture boiling constantly at 65·2° and containing 16·05 per cent. of the former component. The above three liquids also give a constant-boiling mixture, which distils at 61·8°, and has the following percentage composition as ascertained by the middle-point distillation method of S. Young: carbon tetrachloride, 86·3; alcohol, 10·3; water, 3·4.

300. "The behaviour of brass on heating in hydrogen at temperatures below the melting point." By Ernest Alfred Lewis.

While making some experiments to ascertain if oxygen was an essential constituent of brass, the author noticed that, on heating brass in pure dry hydrogen at a temperature of between 700° and 800°, zinc volatilised to a large extent. In the preliminary experiments the brass was heated for one or two hours, and it lost under these conditions from 10 to 20 per cent. of its weight. Further experiments were made, in which the brass was heated for three, six, nine, and twelve hours. It was found that the whole of the zinc could not be driven off even after twelve hours' heating, 3 or 4 per cent. of zinc remaining behind.

The following result is typical of the experiments. 1·001 Gram of very pure brass containing 69·85 per cent. of copper lost 0·272 gram on heating for twelve hours, and the resulting metal contained 96·68 per cent. of copper.

It was further found that if small quantities of tin were present in the brass it did not volatilise, but lead was found to be practically completely volatile. It was noticed that beautiful, microscopical crystals of zinc formed in the cooler part of the tube, but the greater part of the zinc condensed as globules.

Another remarkable result of the experiments was that the metal, after heating, did not become brittle at all; in fact, a piece of sheet brass, heated in hydrogen until a large proportion of its zinc had volatilised, was found when cold to be quite soft and not in the least brittle like a cast and rolled copper sheet would become under the same treatment, due to loss of oxygen.

It may now be considered as proved that chemically combined oxygen is not an essential constituent of alloys of copper and zinc as it is of copper.

301. "Inositol and some of its isomerides."

By Hugo Müller.

The author has continued his investigations on inositol and some of its isomerides, and showed that scyllitol, which was prepared from certain organs of plagiostomous fishes by Staedeler and Frerichs (*J. pr. Chem.*, 1858, **73**, 48), and quercine, obtained from acorns by Vincent and Delachanal (*Compt. rend.*, 1887, **104**, 1855), are identical with cocositol isolated by the author from cocos-palm leaves, and described in 1907 (*Trans.*, **91**, 1767), and, as scyllitol was the first of these substances to be discovered, this name will be retained in future to represent them all.

The author described the action of solutions of hydrogen iodide and hydrogen chloride in acetic acid on inositol hexa-acetate, inositol, scyllitol hexa-acetate, and scyllitol, and showed that the action of hydrogen chloride gives rise to the formation of inositol-chlorohydrin, $C_6H_6Cl(OH)_5$ (m. p. 185°); inositolchlorohydrin triacetate, $C_6H_6Cl(OH)_2(O\cdot CO\cdot CH_3)_3$ (m. p. 145°); and three isomeric modifications (α -, β -, and γ -) of inositolchlorohydrin penta-acetate, $C_6H_6Cl(O\cdot CO\cdot CH_3)_5$, which melt respectively at 247° , 110° , and 118° .

From the mother liquors of the products of all the above-mentioned reactions two new isomerides of inositol were isolated, namely, *isoinositol*, which crystallises in large, transparent crystals melting at 244° , and yields a crystallised *hexa-acetate* (m. p. 112°), and *ψ -inositol*, which is a microcrystalline substance, very soluble in water; the *acetate* is amorphous.

Scyllitol hexa-acetate, when heated with hydrogen bromide in glacial acetic acid, gave derivatives identical with those formerly obtained by the same reaction from inositol hexa-acetate.

302. "The catalytic decomposition of nitrosotriacetoneamine by alkalis." By Douglas Arthur Clibbens and Francis Francis.

The discovery of a method whereby triacetoneamine can be readily prepared in quantity has led to a re-investigation of the decomposition of the nitroso-derivative of this base by means of alkalis. It has been found that the nitrosoamine is catalytically decomposed by hydroxyl ions, giving nitrogen and a nearly quantitative yield

of phorone. This method is by far the easiest yet described for the preparation of this unsaturated ketone.

Experiments have been carried out in aqueous and aqueous-alcoholic solutions with varying concentrations of sodium hydroxide, the corresponding values of the constant for a unimolecular reaction being determined by measurements of the rate of evolution of nitrogen. This kinetic investigation of the reaction has shown that in all probability the decomposition, except over a range from about 0.05*N*- to 0.3*N*-NaOH, will afford a method for the quantitative determination of hydroxyl ions, comparable to that which Bredig and Fraenkel have found for hydrogen ions in the decomposition of diazoacetic ester.

303. "Chlorides of the mercurialkyl- and mercurialkylaryl-ammonium series, and their constitution as based on conductivity measurements." By Prafulla Chandra Rây and Nilratan Dhar.

The preparation of the following compounds was described: (1) Mercurimethylammonium chloride, (2) mercuriisobutylammonium chloride, (3) mercuripiperazinium chloride, (4) mercuribenzylammonium chloride, (5) mercuribenzylmethylammonium chloride, (6) mercuribenzylethylammonium chloride, (7) mercuriethylenediammonium chloride, (8) mercuripyridinium chloride, (9) mercuripicolinium chloride, (10) mercurinicotinium chloride, (11) mercuripiperidinium chloride, and (12) mercurihexamethylenetetraammonium chloride. Although these salts are generally regarded as insoluble, they have been found to be sufficiently soluble to lend themselves to conductivity measurements. It is found that they all conform to the ammonium type of salts.

304. "Position-isomerism and optical activity; halogen derivatives of methyl dibenzoyltartrate." By Percy Faraday Frankland, Sidney Raymond Carter, and Ernest Bryan Adams.

The preparation and properties of the dichloro-, dibromo-, and di-iodo-benzoyl derivatives of methyl tartrate were described. In each series the order of the rotatory power of the compounds, *para* > *meta* > dibenzoyl > *ortho*, is maintained. The rotations were determined in the fused state and over a range of temperature from about 20° to 100°. The rotations as a whole diminish with rise of temperature, but the rotation of each of the *ortho*-compounds attains a maximum value below the melting point, as already found by one of the authors in the case of ethyl dibenzoyl- and of ethyl and methyl di-*o*-toluoyl-tartrates. Incidentally, the *anhydrides* of *p*-chloro- and *m*- and *p*-iodo-benzoic acids have been prepared.

305. "Reactivity of the halogens in organic compounds. Part VII. The formation of intermediate compounds in the hydrolysis of sodium bromoacetate." By George Senter and Thomas John Ward.

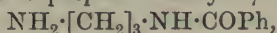
The effect of sodium acetate and of sodium formate on the rate of hydrolysis of sodium bromoacetate has been measured, and the intermediate formation of sodium salts of glycollic esters has been proved by comparison of the results with those to be anticipated on the view that consecutive reactions take place during the hydrolysis.

The rate of hydrolysis of acetylglycollic acid and of sodium acetylglycollate in neutral and alkaline solution and the influence of neutral salts on the rates of reaction have been measured.

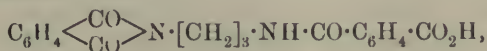
Evidence was adduced to show that during the hydrolysis of sodium bromoacetate in fairly concentrated solution the reaction proceeds mainly by means of the intermediate formation and hydrolysis of sodium bromoacetylglycollate.

306. "2-Phenyl-1:4:5:6-tetrahydropyrimidine and benzoyl- $\alpha\gamma$ -diaminopropane." By Gerald Eyre Kirkwood Branch and Arthur Walsh Titherley.

Numerous attempts to prepare benzoyl- $\alpha\gamma$ -diaminopropane,

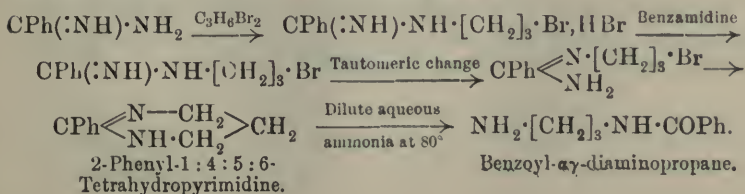


from $\alpha\gamma$ -diphthaliminopropane as starting point proved unsuccessful. It is not possible to eliminate one phthalyl residue from this compound, or to rupture one of the rings, or to obtain the initially desired compound,



from the corresponding diphthalamie acid. The latter, moreover, even on cautious hydrolysis, suffers loss of both phthalyl residues.

Attempts on other lines to prepare benzoyl- $\alpha\gamma$ -diaminopropane were also unsuccessful; but its synthesis was finally effected from benzamidine and $\alpha\gamma$ -dibromopropane through 2-phenyl-1:4:5:6-tetrahydropyrimidine by the following steps:



2-Phenyl-1:4:5:6-tetrahydropyrimidine, which has previously been obtained in an impure form as an oil by Pinner (*Ber.*, 1893, **26**, 2122), is a crystalline solid, melting at 72° , which is not very soluble in water. Its oxalate melts at 175° , and hydrogen oxalate at 180° . On benzylation the base yields tribenzoyl- $\alpha\gamma$ -diaminopropane, $\text{NBz}_2\cdot[\text{CH}_2]_3\cdot\text{NHBz}$ (m. p. 144°).

Benzoyl- $\alpha\gamma$ -diaminopropane crystallises in transparent prisms melting at 46° . It is readily soluble in water, and its oxalate melts at 196° . On benzylation it yields *s*-dibenzoyl- $\alpha\gamma$ -diaminopropane (m. p. 151°).

307. "The magnetic rotation of binary mixtures."

By Frédéric Schwes.

In a binary mixture of liquids, between the changes of density C_v and of magnetic rotation C_r , there is a ratio Z (rotation constant), which possesses as a whole the same properties as the ratio A (refraction constant) between the changes of density and those of refractive power C_n . The common points are:

- (1) For a given system, Z is independent of the concentration.
- (2) The value of Z diminishes with the decrease of wave-length.
- (3) The value of Z is characteristic for each system, and follows some general rules, as, for instance:

(a) If we consider the mixtures of one liquid successively with the different terms of an organic series, Z decreases from the first term upwards.

(b) If we compare the solution of a liquid in water and in alcohol, we find a higher Z -value for the last-named solution.

(c) The values of Z in a carbon disulphide solution are much smaller (three to six times) than in the case of the corresponding aqueous solution; the mixtures with carbon disulphide are also particularly interesting, because they show that the general rules are the same, whether the mixture undergoes a dilatation or a contraction (aqueous mixtures).

(4) In case the mixture undergoes electrolytic dissociation, Z increases with the dilution (=ionisation).

The difference consists in the fact that Z is always smaller than A . For the aqueous mixtures examined, Z has the average value of one-third of A ; but this cannot be regarded as a general rule, as it is only one-sixth for carbon disulphide mixtures.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bayliss, William Maddock. The nature of enzyme action. 2nd edition. London 1911. pp. xi+137. 3s. 6d. net. (*Recd.* 11/11/12.) From Dr. R. H. A. Plimmer.

Hübner, Julius. Bleaching and dyeing of vegetable fibrous materials. London 1912. pp. xxiii+434. ill. 14s. net. (*Recd.* 21/11/12.) From the Author.

[**Field, Frederick**]. The Chemical Alphabet. pp. 4. (*Reference.*) From Mr. William Spiller.

Plimmer, R. H. Aders. The chemical constitution of the proteins. Part I. Analysis. 2nd edition. London 1912. pp. xii+188. 5s. net. (*Recd.* 2/7/12.)

From the Publishers: Messrs. Longmans, Green and Co.

Pope, Frank George. Modern research in organic chemistry. London 1912. pp. xii+324. ill. 7s. 6d. (*Recd.* 19/9/12.)

From the Publishers: Messrs. Methuen and Co.

Royal Society of London. The Record of the Royal Society of London. 3rd edition. London 1912. pp. viii+483. ill. 15s. (*Reference.*) From the Royal Society.

— The signatures in the first Journal-Book and the Charter-Book. Being a facsimile of the signatures of the Founders, Patrons, and Fellows of the Society from the year 1660 down to the present time. London 1912. pp. x+94+42. £3 3s. (*Reference.*)

From the Royal Society.

Richards, Percy Andrew Ellis. Practical chemistry, including simple volumetric analysis and toxicology. 2nd edition. London 1912. pp. x+149. 3s. net. (*Recd.* 14/9/12.)

From the Publishers: Messrs. Baillière, Tindall and Cox.

Thole, Ferdinand Bernard. A second year course of organic chemistry for technical institutes. The carbocyclic compounds. London 1912. pp. vi+186. 2s. 6d. (*Recd.* 19/9/12.)

From the Publishers: Messrs. Methuen and Co.

Villavecchia, Vittorio. Dizionario di merceologia e di chimica applicata. Vol. II. Milano [1912]. pp. [773]. (*Reference.*)

From the Publisher: Ulrico Hoepli.

II. *By Purchase.*

Grüss, J. Biologie und Kapillaranalyse der Enzyme. Berlin 1912. M. 16.—. vi+227. (*Recd.* 16/11/12.)

Hoff, J. H. van't [and others]. Untersuchungen über die Bildungsverhältnisse der ozeanischen Salzablagerungen insbesondere des Stassfurter Salzlagers. Edited by H. Precht and Ernst

Cohen. Leipzig 1912. pp. xx+374. ill. M. 16.—. (*Recd.* 14/11/12.)

Molinari, *Ettore*. Treatise on general and industrial inorganic chemistry. Translated by *Ernest Feilmann*. London 1912. pp. xvi+704. ill. 21s. net. (*Recd.* 14/11/12.)

Pick, *Ernst P.* Biochemie der Antigene. Jena 1912. pp. viii+184. M. 6.50. (*Recd.* 14/11/12.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 2nd, 1912.

All persons who received grants in December, 1911, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Monday, December 2nd.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Scientific Meeting on Thursday, December 5th, 1912, at 8.30 p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"A study of some organic derivatives of tin as regards their relation to the corresponding silicon compounds." By T. A. Smith and F. S. Kipping.

"Contributions to the chemistry of the terpenes. Part XV. Synthesis of a menthadiene from carvacrol." By G. G. Henderson and S. P. Schotz.

"The action of halogens on silver salts." By H. S. Taylor.

"The formation of tetrahydro-oxazoles from α -hydroxy- β -anilino- $\alpha\beta$ -diphenylethane and its homologues." By H. L. Crowther and H. McCombie.

"The precipitation of lead thiosulphate and its behaviour on boiling with water." By W. H. Perkins and A. T. King.

"Studies on cyclic ketones. Part II." By S. Ruhemann and S. I. Levy.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on December 5th, 1912.

Amies, Edwin John, B.Sc.

10, Salisbury Road, Thorpe Hamlet, Norwich.

Science Master, Hitchin Grammar School. B.Sc., First Class Honours (London), 1911. A.R.C.S. 1908–1911: First Class Chemistry.

T. E. Thorpe.

James C. Philip.

M. O. Forster.

W. N. Haworth.

Chapman Jones.

Bailey, William Llewelyn,

Central Buildings, Matlock, Derbyshire.

Student. Member of the Pharmaceutical Society. Student of the Institute of Chemistry. Student in the Laboratory of the Public Analyst for the County of Derby.

T. R. Hodgson.

J. R. Appleyard.

Geo. Clayton.

F. E. Needs.

T. S. Haines.

Baker, James Henry Young,

86, Chestnut Avenue, Hamilton, Ontario, Canada.

Chief Chemist of the Dominion Sugar Refining Co., Canada. Seven years as Assistant Analyst at Messrs. A. Lyle and Sons, London. Eight years as Chief Analytical Chemist of Messrs. Fowler, Ltd., Blackwall, London; now Chief Analyst at Dominion Sugar Co., Canada.

A. E. Dunstan.

R. W. Wilson.

F. B. Thole.

W. H. Barker.

E. D. Griffiths.

Bowack, Douglas Anderson,

15, Belsize Square, Hampstead, London.

Analyst, etc. I received my early training at the City and Guilds, Finsbury College, 1900–1902, and afterwards worked under the supervision of Dr. Arthur Lapworth as a Demonstrator in Chemistry and Research Assistant at the Goldsmiths' Institute, New Cross, London, S.E. From 1905 to 1907 was employed at the Imperial Institute, as Junior Assistant Chemist under Prof. Wyndham R. Dunstan. From 1908–1911, as Chemist, Laboratory Manager, and Lecturer under the Directorship of Mr. John Stewart Remington, Aynsome Analytical and Technical Laboratories, Lanes. Have contributed original work on cellulose, and conducted investigations in the technology of Paper Making. Latterly been associated with Mr. C. F. Cross, of Messrs. Cross and Bevan, London.

Raphael Meldola.

Arthur Lapworth.

Harold G. Colman.

Ernest Goulding.

Thomas Anderson Henry.

B. H. Buttle.

Buckle, Edmund Arthur,

Beech Villa, Guest Road, Prestwich, Manchester.

Chemist. Research on aniline dyestuffs containing sulphur. Research and improved process for the production of ammonia from calcium cyanamide. Research and improved process for the extraction of the self-contained water in peat. Patent specification, No. 10,370, 1912.

Jas. Grant.

F. G. Richards.

F. S. Sinnatt.

H. F. Coward.

S. J. Peachey.

E. L. Rhead.

Challinor, Richard Westman,

"Quidington," Emmerick Street, Leichhardt, Sydney, N.S.W.

Lecturer in Organic Chemistry and Teacher of Chemistry, Sydney Technical College. Training at Sydney Technical College and Sydney University (Honours in Chemistry). Fellow, Institute of Chemistry (1909); Member, Society of Chemical Industry. Paper on "The Approximate Colorimetric Estimation of Nickel and Cobalt in Presence of one another," Royal Society, N.S.W., 7/12/04. Twelve years' experience in teaching Chemistry.

Charles E. Fawsitt.

T. U. Walton.

J. A. Schofield.

F. B. Guthrie.

Henry G. Smith.

Robt. D. Watt.

Coombs, Frank Andrew,

Sydney, New South Wales, Australia.

Lecturer, Tanning Department, Sydney Technical College. Scientific training for the Tanning Industry at Otago and Sydney Universities. Contributions: *Soc. Chem. Ind.*, March 15, 1912; *Technical Gazette, New South Wales*, Feb., 1912, p. 52; *Leather World* (London), 1911, p. 269; Member of International Association, Leather Trades Chemists.

Charles E. Fawsitt.

T. U. Walton.

J. A. Schofield.

John C. H. Mingayo.

Henry G. Smith.

F. B. Guthrie.

Dixon, Walter Henry,

51, High Street, East Grinstead.

Chemist and Pharmacist, M.P.S. For several years in the Chemical, Galenical and Analytical Laboratories of Herrings & Company, 40, Aldersgate Street, and subsequently engaged in local analytical work.

David J. Williams.

J. Stuart Hills.

E. H. Farr.

W. L. Howie.

E. W. Lucas.

J. Adam Watson.

Arthur W. Crossley.

Dodds, H. H., M.Sc.,

Umbogintwini, Natal.

Chemist. For three years student in the Chemical Dept. of the Manchester University; Honours in Chemistry. For two years research chemist in Messrs. Kynoch's Arklow Works. Now chief chemist, Explosives Works, Umbogintwini, Natal.

Harold B. Dixon.

Ch. Weizmann.

W. H. Perkin.

E. C. Edgar.

Norman Smith.

Dyson, James Harry,

North Lea, St. Ives Road, Skircoat Green, Halifax.

Soap manufacturer. City and Guilds of London Certificate for Soap Manufacture. Certificates for Advanced Inorganic and Organic Chemistry. To keep in touch with the latest researches of the chemical trade.

John Denton.

Franklin W. Walker.

E. W. Smith.

Edward M. Chaplin.

C. A. Crook.

Arthur W. Cooke.

Ellis, Ridsdale,

Chalfont House, 20, Queen's Square, Bloomsbury, London.

Patent Agent. B.Sc. in Electrochemistry, Mass. Inst. of Tech., Boston, U.S.A. Papers on Oil Emulsions and Colloids in *J. Soc. Chem. Ind.*, *Amer. Electrochem. Soc.*, and the *Zeit. f. Phys. Chemie.*

F. G. Donnan.

F. Thomas.

R. E. Slade.

H. Bassett, jun.

A. W. Titherley.

Elsdon, George Davidson,

City Analyst's Laboratory, Birmingham.

Senior Assistant Analyst to the City of Birmingham. Lecturer on Chemistry at the Walsall Municipal Technical Institute. B.Sc.(Birm.): Honours in Chemistry. Priestley Research Scholar. Associate of the Institute of Chemistry. Two papers in the *Analyst*; two papers in the *Transactions of the British Pharmaceutical Conference*; one paper in the *Chemical News*; one paper in the *Journal of the Society of Chemical Industry*.

Percy F. Frankland.

Hamilton McCombie.

Edward P. Frankland.

C. K. Tinkler.

H. E. Smith.

Gadd, Sydney Charles,

31, S. David's Hill, Exeter.

Analytical Chemist. Engaged for the last thirteen years in the evaluation of drugs, the standardisation of pharmaceutical products, and the analysis of water, foods, etc. Contributions on chemical and allied subjects to the *Pharmaceutical Journal*, the *Chemist and Druggist*, and the *British Pharmaceutical Conference*.

W. H. Lewis.

J. H. Cooper.

F. Southerden.

Thomas Tickle.

H. Wippell Gadd.

Gray, Harold Heath, B.Sc.,

University Hall, More's Gardens, Cheyne Walk, Chelsea, S.W.

Lecturer in Fuel and Refractory Materials at the Imperial College of Science and Technology, S. K. First Class Honours B.Sc. (Manc.) in Chemistry under Professors Dixon and Perkin. Two years Assistant Lecturer and Demonstrator in Metallurgy and Assaying at McGill University, Montreal, with Prof. A. Stansfield, D.Sc. Three years Assistant Lecturer and Demonstrator at Leeds University in the Department of Fuel and Metallurgy with Professor Bone, during

which time did Research on High Pressure Gaseous Explosions under the direction of, and in collaboration with, him.

William A. Bone.

W. H. Perkin.

Harold B. Dixon.

Ch. Weizmann.

E. C. Edgar.

Norman Smith.

Hale, Arthur James, B.Sc. (Lond.), A.I.C.,

53, Gowrie Road, Lavender Hill, S.W.

Lecturer and Demonstrator of Chemistry, City and Guilds Technical College, Finsbury. Former Student at Chelsea and Borough Polytechnics. Lecturer in Chemistry and Physics, Waterford Technical Institute, Jan. 1907—Oct. 1910. Assisted Dr. F. M. Perkin in preparation of "Practical Methods of Inorganic Chemistry." Author of "Practical Chemistry for Engineering Students," Longmans, 1912.

Raphael Meldola.

H. Drake Law.

F. Mollwo Perkin.

J. Bernard Coleman.

B. H. Buttle.

F. H. Lowe.

Haydon, Archie,

55, Grove Lane, Kingston, Surrey.

Assistant to T. Hughes, Esq., F.I.C., F.C.S., Public Analyst, for the past three years. For two and a-half years Assistant to P. Edgerton, Esq., F.C.S., Consulting Chemist. Student of the Battersea Polytechnic. Four years training at Shebbear College, N. Devon.

Thomas Hughes.

John Wilson.

Percy Edgerton.

J. L. White.

B. A. Posford.

Hope, Edward, M.Sc.,

Lockingstoops, Lowton, Newton-le-Willows, Lancs.

Demonstrator in Chemistry, Manchester University. Late Dalton Chemical Scholar, and Schunck Research Assistant, Manchester University. M.Sc. Manchester. Author and joint-author of papers in the publications of the Chemical Society.

Harold B. Dixon.

A. Lapworth.

W. H. Perkin.

A. Holt.

F. P. Burt.

Norman Smith.

J. E. Myers.

Jamas, A. N. Peston, M.A., B.Sc.,

Karrim Building, Grant Road, Bombay.

Geologist, Eastern Syndicate, Ltd., London. M.A. with Chemistry and B.Sc. with Chemistry and Geology of the Bombay University.

Worked as a Chemical Analyst in the Technochemical Laboratory, Bombay. Sometime State Geologist and Chemical Adviser, State of Jamnagar. I always take interest in the Chemical Science and desire to promote my knowledge thereon.

Alex. R. Normand.

E. M. Modi.

T. K. Gajjar.

A. Weighell.

A. S. Lindley.

Jobling, Edgar,

H.M. Patent Office, Southampton Buildings, W.C.

Assistant Examiner in Patent Office. National Scholar, Governor's Scholar, Tyndall and Frank Hatton Prizeman; Royal College of Science, London, S.W. Associate of the Royal College of Science. Bachelor of Science (London: First Class Honours in Chemistry). Post-graduate research at the above College. At present, researching at the Birkbeck College, London, E.C.

G. T. Morgan.

F. P. Dunn.

James C. Philip.

J. C. Withers.

M. O. Forster.

Alex. McKenzie.

Komatsu, Shigeru,

Institute of Chemistry, College of Science and Engineering,
Kyoto Imperial University, Kyoto, Japan.

Assistant Professor of Chemistry. Contributions to Chemistry: (1) Isomeric phenyl phthalimides and some allied compounds, I, II. (with Prof. Kuhara): *Mem. Coll. Sci. Eng. Kyoto*, I, 391; II, 365. (2) Amine salts of phthalamic, phenylphthalamic, and phenylsuccinamic acids (*Ibid.*, I, 431). (3) Synthesis of thiohydantoin (*Ibid.*, III, 1).

Joji Sakurai.

Toyokichi Takamatsu.

Tanemasa Haga.

Hikorokuro Yoshida.

Masumi Chikashigé.

Lankshear, Frederick Russell, B.A., M.Sc.,

Dalton Hall, Victoria Park, Manchester.

Lecturer in Chemistry in the University of Manchester. Author of following papers: "On Epicamphor" (with Prof. W. H. Perkin); "Absorption Spectra of Camphorquinone Derivatives" (with Dr. Lapworth); "On Manganose Trioxide," in the *Proceedings of the Chemical Society*.

Harold B. Dixon.

E. C. Edgar.

W. H. Perkin.

Arthur Lapworth.

Ch. Weizmann.

Norman Smith.

Levy, Stanley Isaac,

St. John's College, Cambridge.

Student; engaged in research with Dr. Ruhemann. B.A. (Cambridge): First Class in Nat. Sci. Tripos, Parts I. and II. (Chemistry). B.Sc. London: First Class Honours in Chemistry.

S. Ruhemann.

H. O. Jones.

E. J. Holmyard.

W. J. Pope.

Charles T. Heycock.

W. J. Sell.

Lomax, Ernest Lawson,

Mowbreck, Farington, near Preston, Lancs.

Petroleum Chemist. Master of Science, Victoria University, Manchester. Johnstone Chemical Scholar, Durham University, 1903-4. Research Chemist, Woolwich Arsenal, two years. Petroleum chemist, six years. Joint author with F. C. Garrett, D.Sc., of "Determination of Sulphur in Petroleum and Bituminous Minerals," *Journal of the Society of Chemical Industry*, 1905, 1212, 1213.

Boverton Redwood.

Chas. W. Moore.

W. H. Perkin.

F. G. P. Remfry.

E. C. Edgar.

R. G. Neilson.

Morrell, George Francis,

7, Claylands Road, Kennington Gate, S.W.

Assistant Lecturer at Sir John Cass Institute. Ph.D.(Kiel); B.Sc. Hons. Chem. (Lond.); A.I.C.

Arthur W. Crossley.

Charles A. Keane.

Charles H. Warner.

H. Burrows.

J. F. Spencer.

Mumford, Ernest Moore, B.Sc.,

75, High Street, Chorlton-on-Medlock, Manchester.

Chemist. B.Sc. Honours in Chemistry, Manchester University. Assistant to Dr. Fowler, Lecturer in Bacteriological Chemistry in the University of Manchester.

Gilbert J. Fowler.

E. C. Edgar.

Harold B. Dixon.

J. E. Myers.

W. H. Perkin.

Ch. Weizmann.

Norman Smith.

Newman, Leslie Frank,

Downing College, Cambridge.

Advisory Chemist in Agriculture for the South Eastern Counties

(Camb. Univ.). B.A. (Camb.), Univ. Dip. Agr. Research Scholar for three years under Professor T. B. Wood.

T. B. Wood.

H. A. D. Neville.

F. G. Hopkins.

Charles T. Heycock.

R. H. Adie.

Nichols, William Moore,

205, Hugh Street, Castleford.

Analytical Chemist, Specialising Brewing Chemistry. Studied Chemistry with E. G. McBretney, Esq., F.I.C.; later, a Student at the Wakefield Technical School. More than two years with E. M. Chaplin, Esq., Ph.D., F.I.C., Public Analyst for Wakefield and Lincoln. Now Controlling Chemist to F. Fawcett, Esq., Maltster, Castleford.

Edward M. Chaplin.

B. A. Burrell.

E. G. McBretney.

F. W. Richardson.

L. Gordon Paul.

Nierenstein, Maximilian,

30, Cavendish Road, Henleaze, Bristol.

Lecturer in Bio-chemistry, University of Bristol. Ph.D. (Berne). Has been engaged in research work on Organic and Bio-chemical lines since 1902, and has published several papers in the *Berichte, Annalen*, and other journals.

F. W. Rixon.

Philip J. Worsley.

H. W. Bywaters.

Francis Francis.

James W. McBain.

Orange, Lionel,

148, Barkworth Road, N. Camberwell, London, S.E.

Senior Science Master, Shebbear College, Shebbear, near High-ampton, N. Devon, since Sept., 1911. B.Sc. London, First Class Honours in Chemistry, 1910. Student under Dr. J. T. Hewitt at East London College, 1907-1910.

J. T. Hewitt.

Frank G. Pope.

Clarence Smith.

W. H. Ratcliffe.

Arthur E. Pitt.

Paniker, Ramni,

c/o Messrs. Röhm & Haas, 4, Quai St. Clair, Lyons, France.

Leather Trades Chemist. M.A. (Madras University, Chemistry); M.Sc. (Leeds University, Applied Chemistry, Leather Manufacture). "Acid Character of Gallotannic Acid," by Paniker and Stiasny, *J.C.S.*, October, 1911.

Arthur Smithells.

J. B. Cohen.

Henry R. Procter.

H. M. Dawson.

A. G. Green.

Patterson, John William,

88, Park Road, West Dulwich, London, S.E.

Pharmaceutical Chemist. Chemist to a firm of Manufacturing Pharmaceutical Chemists, Messrs. G. Curling, Wyman & Co., 58 and 59, Bunhill Row, London, E.C. Member of the Pharmaceutical Society. Pereira Medallist, 1902.

Carter White.

R. Ernest Jackson.

Harold Rogerson.

James Brown.

William C. Reynolds.

Potter, Charles Etty,

9, Church View, Church Lane, Heckmondwike, Yorks.

Teacher of Chemistry. B.Sc. Victoria (Manchester), June, 1900. Joint author of contributions to the Chemical Society (*J.C.S.*, 1902-3-4), with Dr. H. A. D. Jowett. Lecturer in Chemistry, Batley Technical School.

Arthur Smithells.

J. B. Cohen.

W. Lowson.

H. M. Dawson.

Frederick B. Power.

Rakshit, Jitendra Nath,

11/1, Bahar Urijapur Road, Calcutta.

Assistant to the Customs and Excise Chemist, India. Author: "On Sodium Diametamide and Potassium Acetamide," *Journal Asiatic Society, Bengal* (1902). Joint author with Prof. P. C. Rây, "Methylammonium Nitrite" (*Trans.*, 99, 1016); "Nitrites of the Alkylammonium Bases," Parts I, II, III, IV (*Trans.*, 99, 1470; 101, 141, 217, 613); "Trimercuridiethylammonium Nitrite" (*Trans.*, 99, 1972), etc., etc. Awarded Elliot Gold Medal for researches in 1912 by the Asiatic Society of Bengal.

M. N. Banerjee.

P. C. Rây.

Jyoti Bhushan Bhaduri.

C. L. Bose.

R. L. Jenks.

B. C. Dutt.

Remers, Martin,

24, Chorley Old Road, Bolton.

Physician. Student in Chemical and Pharmaceutical Laboratories of the Manchester University. Minor Qualification of Pharmaceutical Society; L.R.C.P., Edinburgh; L.R.C.S., Edinburgh.

Harold B. Dixon.

Norman Smith.

W. H. Perkin.

Alfred Holt.

E. C. Edgar.

J. E. Myers.

Roper, Herbert Carr,

42, Cavendish Place, Newcastle-on-Tyne.

Pharmacist. Engaged for the past twenty-one years in manufacturing, analysing, and dispensing drugs and pharmaceutical compounds, and greatly interested in the chemical constitution of medicinal substances.

N. H. Martin.

J. T. Dunn.

Frederick N. Binks.

P. Phillips Bedson.

F. C. Garrett.

Sasson, Albert,

Alexandria, Egypt.

Inspector of Agriculture (Egypt). Member of the Royal Agricultural College, Cirencester, and Gold Medallist. Student, 1903-1905. Desirous of keeping up knowledge of Agricultural Chemistry.

Edward Kinch.

W. H. Cadman.

J. A. Voelcker.

A. Lucas.

W. B. Pollard.

Scarborough, Harold Archibald,

60, Highbury Terrace, Hill Street, Coventry.

Research Student. B.Sc. (Honours), Birmingham.

Percy F. Frankland.

C. K. Tinkler.

Hamilton McCombie.

J. E. Coates.

E. P. Frankland.

H. E. Smith.

Ernest Vanstone.

John Wilfrid Parkes.

Scott, Walter,

2, Wordsworth Avenue, Cardiff.

Technical and Analytical Chemist. Technical and Analytical Chemist in Cardiff, after acting as Chemist for Messrs. Powell, Duffryn Co., Ltd., South Wales, for past seven years. I have made, and am now making, a close investigation into the subject of Lubrication, and Oils and Greases generally.

Harold Gripper.

Jas. Grant.

William J. Pope.

F. G. Richards.

Edmund Knecht.

F. S. Sinnatt.

Seal, Kunjo Behary,

5, Nilmony Dutt Lane, Calcutta, India.

Head Analytical Assistant to the Custom and Excise Chemist, Government of India. Head Assistant in the Laboratory of the Chemical Examiner to Government, Bengal, and Head Lecturo-

Assistant to the Professor of Chemistry, Medical College, Calcutta, from 1896 to 1904; Head Analytical Assistant, Central Excise Laboratory for India under Lieut.-Col. Sir C. H. Bedford, M.D., D.Sc., I.M.S., from 1904 to 1911; Head Analytical Assistant to the Custom and Excise Chemist, Government of India, since January, 1912; Assistant to the Lecturer of Chemistry, Indian Association for the Cultivation of Science, Calcutta, for many years. Assisted generally in all the original Excise Investigations for the Government of India, namely: (1) Quality, manufacture, and Excise control of alcoholic liquors in India (1906). (2) Report on denaturation of alcohol in India (1907). (3) Standards of quality for beer in India (1907). (4) Corrected Sikes' Tables for use with glass hydrometer (1909). (5) Report on contamination of country spirit by copper salts (1910). (6) Tables for the reduction of spirit of strengths between 65 O.P. to 70 U.P. (1910). (7) Custom observation Report (1911).

Chuni Lal Bose.

Haradhan Ray.

Amrita Lal Sircar

R. L. Jenks.

Manindra Nath Banerjee.

Sladden, Cyril Edgar,

12, Charleville Circus, Sydenham, S.E.

Assistant Demonstrator at the Imperial College of Science and Technology, South Kensington. B.A. Oxford, Second Class Honours, Natural Science (Chemistry), 1912.

H. Brereton Baker.

Henry F. Harwood.

James C. Philip.

P. W. Robertson.

Oscar L. Brady.

Smith, Thomas Alfred,

3, Colegrave Street, Lincoln.

Chemical Research Assistant. B.Sc. (Hons. Lond.); A.I.C. At present engaged in research with Prof. F. S. Kipping at University College, Nottingham, and Lecturer at Loughborough Technical Institute.

F. Stanley Kipping.

H. J. S. Sand.

R. M. Caven.

Robert Robison.

Frederick Challenger.

Smith, William Charles,

Church Lane, Lowton, Newton-le-Willows.

Analytical Chemist to Anchor Cable Co., Leigh, Lancs. For six years as assistant to Messrs. Stanger & Blount, Westminster; three

years with R. H. H. Stanger, of Westminster; and the last four years as Chemist to the Anchor Cable Co., Leigh (Messrs. Callenders).

Bertram Blount.

S. Dickson.

W. J. A. Butterfield.

R. H. Harry Stanger.

C. T. Blanshard.

Steele, Victor,

438, New Cross Road, New Cross, S.E.

Lecturers' Assistant, Chemical Department, Guy's Hospital, S.E. Lecture Assistant, Chemical Department, Goldsmiths' College, New Cross, 1905—1910. Research Chemist at South Metropolitan Gas Co. until 1912. Joint Author with Dr. Lapworth of two papers in the *Transactions* (1911, 99, 1877, and 1911, 99, 1882), and author of "The Action of Hydrogen Cyanide on Carvone Hydrosulphide" (*Proc.*, 1911, 27, 240).

Arthur Lapworth.

Richard William Merriman.

George Barger.

Harold Rogerson.

J. H. Ryffel.

Stephen, Alfred Ernest,

Bank of New South Wales, Sydney, New South Wales, Australia.

Delegate for Australasia of the Chilian Nitrate Committee. Two and a-half years with W. A. Dixon, F.I.C., F.C.S., and G. A. Byrn, F.I.C., F.C.S., Public Analysts, Sydney. Four and a-half years Analyst to the Pacific Phosphate Co., Ltd. (London), at Sydney and South Sea Islands. Three and three-quarter years Chief Metallurgical Chemist (a) Lachlan Gold Fields, Ltd., N.S.W.; (b) Great Cobar, Ltd., Cobar, N.S.W. Three years Assistant Propagandist for German Potash Syndicate in Australia, etc., etc.

Bernard Dyer.

J. A. Voelcker.

Arthur R. Ling.

E. W. Voelcker.

John Hughes.

Arthur W. Crossley.

Till, William Compton,

Barnacle House, Coventry.

At present engaged in private research. M.Sc. (Birm.). Nearly two years original research on Biological Chemistry, including work on "The Interaction of Dextrose with Various Organic Substances," and "The Acid Production of a Bacterium Allied to *Saccharobacillus Pastorianus*."

Percy F. Frankland.

Thomas H. Pope.

Adrian J. Brown.

Douglas F. Twiss.

Hamilton McCombie.

Tsao, Hui Chun,

I-Hing, Kiang-Su, China.

Student of Chemistry and Metallurgy. B.Sc. (Birm.).

Percy F. Frankland.

J. E. Coates.

Hamilton McCombie.

C. K. Tinkler.

Thomas Turner.

Ure, Paul Jenner,

c/o Dr. Ure, George Street, Brisbane, Queensland, Australia.

Assistant Teacher and Lecturer in Chemistry, Assaying, Mineralogy, and Geology at Central Technical College, Brisbane. Student about three years at Brisbane Technical College. Associate Diploma in Chemistry, Assaying, Mineralogy and Geology with honour. Teaching experience: Four years teaching at the Brisbane and Central Technical Colleges, Brisbane. Now Public Assayer and Metallurgical Chemist.

George J. Saunders.

Leonard C. Green.

J. Brownlie Henderson.

J. A. Schofield.

Basil Turner.

The following Certificates have been authorised by the Council for presentation to ballot under Bye-law I(3):—

Douglas, James Crawford,

Christmas Island, Straits Settlements.

Analytical Chemist. Studied Chemistry (inorganic and organic) at the Technical College, Glasgow. Hold Honours certificate (South Kensington) for Chemistry (practical and theoretical); six years Assistant Chemist to Messrs. Alex. Cross & Sons, Ltd., Glasgow. At present Chemist to the Christmas Island Phosphate Co., Ltd. Desire to have the Society's Journal and other publications.

William Smellie Anderson.

Isidor M. Heilbron.

G. G. Henderson.

Forsyth James Wilson.

Edmund J. Mills.

Grützmacher, Frederick Lyle,

Technical College, Rockhampton, Queensland, Australia.

Science Lecturer. Lecturer in Chemistry, Mineralogy and Geology, and Director of Science Department, Rockhampton Technical College; formerly Science Master, Rockhampton Grammar School. Explosives Analyst for Harbour Board, Rockhampton.

Edward H. Rennie.

J. Brownlie Henderson.

Hilbert, Max,

Hamburg, Germany.

Manufacturing Chemist, Essential Oil Importer and Exporter. Contributor, Investigator and Author in connexion with Sicilian and Calabrian oils, in particular in connexion with the purity of Oil of Lemon.

John C. Umney.

Frank L. Teed.

C. T. Bennett.

H. Mansfield.

Maxwell, Francis,

77, Lawrie Park Road, Sydenham, London.

Chemical and Technical Advisor of the factories of the Credit Foncier of Mauritius. Certificated Chemist of the Brunswick Sugar Institute. Ingénieur of the Swiss Federal Polytechnikum and A.M.I.M.E. Inventor of his procédé of making white sugar direct from the sugar-cane as in operation in Mauritius.

Walter M. Gardner.

Barker North.

F. W. Richardson.

H. Middleton.

A. B. Knaggs.

Natrajan, Tanjore S.,

Bixandarkoil, Trichinopoly.

Professor of Chemistry S.P.G. College, Trichinopoly. Worked in the Chemical and Physical laboratories (for the B.A. and M.A. Courses for five years), Presidency College, Madras.

A. K. Yegna Narayan Aiyer.

H. V. Krishnayya.

Nowak, Carl Alfred,

2739 Mildred Avenue, Chicago, Ill., U.S.A.

Head Research Chemist and Instructor in Chemistry and Physics, The Wahl-Henius Institute of Fermentology, Chicago, Ill. B.Sc. with Honours, University of Chicago, 1910. Member and Abstractor, American Chemical Society. Member Bureau of Barley and Hop Industry. Author of Paper on "The Materials used in the Manufacture of Filtermass," *8th Inter. Congress of Applied Chem.*, and "Conductivity Cell," *J. Ind. Eng. Chem.*, Sept. 1912. Contributor Scientific Dep. *American Brewer's Rev.* Inventor and Patentee Carbon-tetrachlorid Emulsion, U.S. Patent 1,038,783.

Max Henius.

Alexander Smith.

Alan W. C. Menzies.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 28

No. 407.

Thursday, December 5th, 1912, at 8.30 p.m., Dr. M. O. FORSTER, F.R.S., Vice-President, in the Chair.

Captain G. I. Davys was formally admitted a Fellow of the Society.

The CHAIRMAN announced that the Council had decided:

(1) That in order to obtain a more equal division of abstracts, those of Physiological Chemistry and the Chemistry of Vegetable Physiology and Agriculture shall, in future, be included in Part I. of the Abstracts, instead of in Part II.

(2) That persons requiring expanded Abstracts or translations of papers published in other Journals should apply to the Editor. Ten shillings per printed page (about 500 words) will be charged, and payment should be made to the Editor at the time the request for a translation or fuller abstract is forwarded to him.

Certificates were read for the first time in favour of Messrs.:

Theodore William Gull Acland, B.A., 19, Bryanston Square, W.

Albert Brier, M.Sc., 19, Alexander Road, Ulverston.

Charles George Cutbush, 59, Byne Road, Sydenham, S.E.

Thomas Lenton Elliott, Lincoln House, Heckmondwike, Yorks.

Robert Gilmour, B.Sc., Ph.D., Scores Villa West, St. Andrews.

James Arthur Hewitt, B.Sc., 3, South Bridge Street, St. Andrews.

William Joseph Holt, 31, Spruce Hills Road, Walthamstow, N.E.
Paul Murphy, Burnside, Sidcup, Kent.

Jonathan Harold Naylor, M.Sc., 73, Castle Street, Bolton.

Harold Victor Taylor, Royal College of Science, S. Kensington,
S.W.

Percy James Thompson, The Avenue, Clytha Square, Newport,
Mon.

Thomas Willoughby Turnill, Stibbington, Wansford, Northamp-
tonshire.

Edward Webb, B.Sc., Berwyn, Totteridge, Whetstone.

A Ballot for the election of Fellows was held, and the following
were subsequently declared duly elected:

Edwin John Amies, B.Sc.

William Llewelyn Baily.

James Henry Young Baker.

Douglas Anderson Bowak.

Edmund Arthur Buckle.

Richard Westman Challinor.

Frank Andrew Coombs.

Walter Henry Dixon.

H. H. Dodds, M.Sc.

James Crawford Douglas.

James Harry Dyson.

Ridsdale Ellis, B.Sc.

George Davidson Elsdon, B.Sc.

Sydney Charles Gadd.

Harold Heath Gray, B.Sc.

Frederick Lyle Grützmacher.

Arthur James Hale, B.Sc.

Archie Haydon.

Edward Hope, M.Sc.

Ardesir Naservanji Peston Jamas, M.A.,
B.Sc.

Edgar Jobling, B.Sc.

Shigeru Komatsu.

Frederick Russell Lankshear, B.A.,
M.Sc.

Stanley Isaac Levy, B.A., B.Sc.

Ernest Lawson Lomax, M.Sc.

Francis Maxwell.

George Francis Morrell, Ph.D., B.Sc.

Ernest Moore Mumford, B.Sc.

Tanjore S. Natrajan.

Leslie Frank Newman, B.A.

William Moore Nichols.

Maximilian Nierenstein, Ph.D.

Carl Alfred Nowak, B.Sc.

Lionel Orange, B.Sc.

Ramni Paniker, M.A., M.Sc.

John William Patterson.

Charles Ety Potter, B.Sc.

Jitendra Nath Rakshit.

Martin Remers, L.R.C.P., L.R.C.S.

Herbert Carr Roper.

Albert Sasson.

Harold Archibald Scarborough, B.Sc.

Walter Scott.

Kunjo Behary Seal.

Cyril Edgar Sladden, B.A.

Alfred Thomas Smith, B.Sc.

William Charles Smith.

Victor Steele.

Alfred Ernest Stephen.

William Compton Till, M.Sc.

Hui Chun Tsao, B.Sc.

Paul Jenner Ure.

Of the following papers those marked * were read:

- *308. "Chemical reactivity and absorption spectra. Part II. The
variation in absorption produced by a solvent." By Edward
Charles Cyril Baly and Francis Owen Rice.

In two previous papers (Trans., 1912, 101, 1469, 1475) it was
pointed out that every chemical molecule must be the centre of a
condensed field of force. Each individual atom in any given

molecule possesses a certain amount of free affinity, which must be accompanied by the existence of lines of force in its immediate neighbourhood. Inasmuch as there exist two types of this affinity, acid and basic, it follows that the independent existence of these lines of force in a molecule must be a metastable condition, and that the various force lines must condense together with the escape of free energy. The chemical reactivity of the resulting condensed system will be very much reduced, and in some cases may fall to zero. It has been shown how these systems can be unlocked by the action of light, and how the reactivity thereby may be increased. In many cases the closed system can partly be opened by the influence of a solvent, and under the influence of light they may still further be opened. A quantitative measure of the amount of light absorbed by substances at various concentrations in suitable solvents has been carried out.

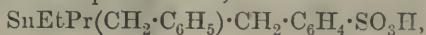
As a result of this theory it would be expected, in the case when a substance is opened up by a solvent, that the amount of light absorbed should increase with the dilution until a maximum is reached. Further dilution should then cause a decrease in the amount of light absorbed, and finally the solution should become diactic. This result has experimentally been found.

***309. "Studies in the camphane series. Part XXXIII. Orientation of Tiemann's *isoaminocamphor*." By Martin Onslow Forster and Hubert Arthur Harry Howard.**

Tiemann's *isoaminocamphor*, produced by the action of hydriodic acid on camphoroxime, was found to have the amino-group in the position occupied by the substituent in β -chlorocamphor, β -bromocamphor, and Reychler's camphorsulphonic acid. It is therefore re-named β -aminocamphor, and by hydrolysing the hydroxycamphor *semicarbazone*, $C_{11}H_{19}O_2N_3$, which arises by exchange of the amino-group for hydroxyl when semicarbazide acetate acts on β -aminocamphor, β -*hydroxycamphor*, $C_{10}H_{16}O_2$, has been prepared; the substance is short-lived, rapidly changing into the isomeric dihydrocampholenolactone.

310. "A study of some organic derivatives of tin as regards their relation to the corresponding silicon compounds." By Thomas Alfred Smith and Frederic Stanley Kipping.

As the results of a comparison of optically active derivatives of tin with the corresponding silicon compounds might lead to important conclusions, attempts have been made to synthesise *dl*-dibenzylethylpropylstannanesulphonic acid,



by methods analogous to those employed in the preparation of dibenzylethylpropylsilicanesulphonic acid (Challenger and Kipping, *Trans.*, 1910, **97**, 142, 755). These experiments were successful only up to a certain point, for although *dibenzylethylpropylstannane* was, in fact, obtained, the *dl*-monosulphonic derivative of this compound could not be prepared.

The following benzyl and benzylalkyl derivatives of stannic chloride were described: *Dibenzylstannic chloride*, *bromide*, *iodide*, and *acetate*; *tetrabenzylstannane*, *tribenzylethylstannane*, *dibenzyl-diethylstannane*, and *dibenzylethylpropylstannane*. *Ethylpropylstannic chloride* was also obtained.

311. "Contributions to the chemistry of the terpenes. Part XV. Synthesis of a menthadiene from carvacrol." By George Gerald Henderson and Schachno Peisach Schotz.

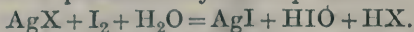
Carvomenthol, $C_{10}H_{18} \cdot OH$, prepared by hydrogenating carvacrol according to the method of Sabatier and Senderens, yields Δ^1 -menthene, $C_{10}H_{18}$, when heated with anhydrous oxalic acid. The hydrocarbon forms an oily dibromide, $C_{10}H_{18}Br_2$, which, when heated with alcoholic potassium hydroxide or with anhydrous sodium acetate and acetic acid, is converted into a *menthadiene*, $C_{10}H_{16}$, a colourless liquid with a pleasant odour, which boils at $172-174^\circ$.

It was expected that the product of these reactions would be either α - or β -phellandrene, but this was not the case; at least, it could not be converted into a nitrite. On the other hand, the menthadiene obtained in this way from carvacrol has considerable resemblance to the corresponding hydrocarbon formerly obtained from thymol by a similar process, although it has not been proved that they are identical.

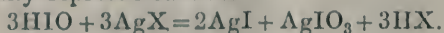
312. "The action of halogens on silver salts."

By Hugh Stett Taylor.

Iodine reacts with silver salts in a manner analogous to that observed in reactions with chlorine and bromine, to yield insoluble silver iodide, hypoiodous acid, and another acid. The reaction occurring may be represented by the equation:

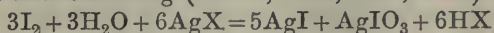


Owing to the instability of hypoiodous acid, a second reaction occurs, accelerated by rise of temperature, increase in concentration, or presence of soluble silver salts, in which the hypoiodous acid is converted into iodide and iodate. This secondary reaction may be generally represented thus:



The progress of this second reaction has been followed in various concentrations of the reacting solutions.

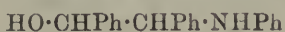
The simple equation of Birnbaum (*Annalen*, 1869, **152**, 111) and of Normand and Cumming (*Trans.*, 1912, **101**, 1852):



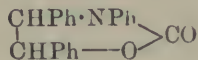
represents the sum of the two preceding equations.

313. "The formation of tetrahydro-oxazoles from α -hydroxy- β -anilino- $\alpha\beta$ -diphenylethane and its homologues." By Horace Leslie Crowther and Hamilton McCombie.

Tetrahydro-oxazoles cannot be prepared from the dihydro-oxazoles described by McCombie and Parkes (*Trans.*, 1912, **101**, 1991) by simple reduction. If, however, α -keto- β -anilino- $\alpha\beta$ -diphenylethane is reduced to the corresponding hydroxy-compound (I) by means of sodium amalgam in alcohol, this compound then undergoes condensation with carbonyl chloride to yield 3:4:5-triphenyl-2:3:4:5-tetrahydro-2-oxazolone (II):



(I.)



(II.)

Similar compounds have been prepared from the corresponding *m*- and *p*-toluidines and β -naphthylamine analogues of (I).

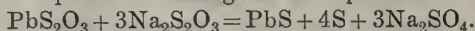
The tetrahydro-oxazoles obtained are very stable substances, which resist the action of reducing agents and phosphorus trichloride, and do not form salts with hydrochloric acid or with picric acid.

Attempts were also made to condense α -hydroxy- β -anilino- $\alpha\beta$ -diphenylethane and its homologues with thionyl chloride and sulphuryl chloride, but these were unsuccessful.

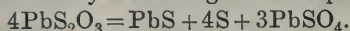
314. "The precipitation of lead thiosulphate and its behaviour on boiling with water." By William Hughes Perkins and Albert Theodore King.

The addition of sodium thiosulphate to a solution of lead acetate produces a precipitate the composition of which varies with the dilution of the solutions, and with the proportions in which they are mixed. From concentrated solutions, especially those containing excess of the lead salt, the precipitate consists of the double salt $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{PbS}_2\text{O}_3$, whilst from dilute solutions or with excess of thiosulphate it has a composition corresponding with PbS_2O_3 . It is therefore advisable when pure lead thiosulphate is required to obtain it from lead nitrate. The well-known blackening of this

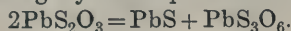
salt on warming takes place most readily in the presence of excess of sodium thiosulphate according to the equation



Without the sodium salt the reaction is slower and more complex, but it still proceeds mainly according to the equation



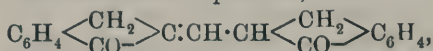
The authors' results are in conflict with those of Fogh (*Ann. Chim. Phys.*, 1890, [vi], 21, 56), who prepared his thiosulphate from moderately concentrated lead acetate solution, and represented its decomposition on boiling by the equation



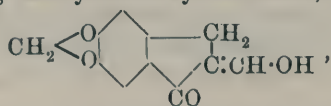
315. "Studies on cyclic ketones. Part II."

By Siegfried Ruhemann and Stanley Isaac Levy.

The work on cyclic ketones (Ruhemann, *Trans.*, 1912, 101, 1729) has been continued on the same lines as before; in particular, the authors have examined the hydroxymethylene derivatives of various cyclic ketones. They find that 2-hydroxymethylene-1-hydrindone, $\text{C}_6\text{H}_4\langle\text{CH}_2\text{CO}\rangle\text{C}:\text{CH}\cdot\text{OH}$, a colourless solid soluble in alcohol, undergoes on warming a remarkable transformation, involving the elimination of one molecule of formic acid from two molecules of the substance; the condensation product,



is a deep red solid, insoluble in alcohol, and decomposing at 232° . The corresponding methylenedioxy-derivative,



undergoes the same change at a somewhat higher temperature; but the hydroxymethylene derivatives of 1:3-dimethyl- Δ^3 -cyclohexen-5-one, $\text{CHMe}\langle\text{C}(\text{CH}\cdot\text{OH})\cdot\text{CO}\rangle\text{CH}_2\text{CMe}\rangle\text{CH}$, which is a yellow oil, and of

1-methylcyclopentan-3-one, $\text{CHMe}\langle\text{CH}_2\cdot\text{CO}\rangle\text{C}:\text{CH}\cdot\text{OH}$, which is a very volatile, colourless solid, can both be distilled in a vacuum without change.

In other respects the hydroxymethylene derivatives of the hydrindone series resemble those already examined by Claisen and his pupils; thus they yield green copper salts, and anilides, and react with semicarbazide, and with phenylhydrazine, in the latter case forming pyrazole derivatives.

316. "Some hydrogen ferrocyanides." By Herbert Ernest Williams.

By treating solutions of the ferrocyanides of the alkali or alkaline earth metals with hydrochloric acid, ferrocyanic acid is liberated.

The ferrocyanides of the heavy metals, however, behave differently; thus, when cupric ferrocyanide is boiled with concentrated hydrochloric acid, half of the copper is replaced by hydrogen, and there is obtained a yellow, insoluble *cupric hydrogen ferrocyanide*, $\text{CuH}_2\text{Fe}(\text{CN})_6 \cdot 4\text{H}_2\text{O}$.

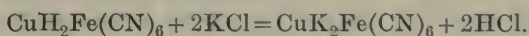
In a similar manner, but with slight variation of conditions, such as lower temperature or diluted acid, double hydrogen salts of nickel, cobalt, manganese, zinc, and cadmium can be obtained.

By these means the following compounds have been prepared and examined: *Cobalt hydrogen ferrocyanide*, $\text{CoH}_2\text{Fe}(\text{CN})_6 \cdot 4\text{H}_2\text{O}$; *manganese hydrogen ferrocyanide*, $\text{MnH}_2\text{Fe}(\text{CN})_6 \cdot 5\text{H}_2\text{O}$; and *nickel hydrogen ferrocyanide*, $\text{NiH}_2\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$.

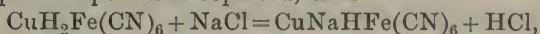
These acid salts are insoluble in water, and decompose alkali carbonates readily with liberation of carbon dioxide, and when digested in solutions of the chlorides of the alkali metals, hydrochloric acid is liberated.

The cupric salt, when digested with solutions of potassium or ammonium chlorides, liberates two equivalents of hydrochloric acid, and forms the corresponding cupric potassium or cupric ammonium ferrocyanide respectively.

With potassium chloride the reaction is represented by the equation:



With sodium chloride solution in the cold only half the hydrogen of the copper compound is replaced, thus:



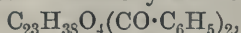
forming the triple salt, *cupric sodium hydrogen ferrocyanide*, which has a dirty brown colour. When this triple salt is digested in a solution of potassium or ammonium chloride, the remaining hydrogen atom is replaced, forming one equivalent of hydrochloric acid and cupric sodium potassium or cupric sodium ammonium ferrocyanide respectively.

317. "The formulæ of ipuranol and some related compounds."

By Frank Tutin and Hubert William Bentley Clewer.

In a paper published some time ago (*Amer. J. Pharm.*, 1908, **80**, 264) Power and Rogerson described the isolation from *Ipomœa purpurea* of a substance which was designated ipuranol, and since then the same compound has repeatedly been obtained from a

variety of plants. The analysis of the ipuranol, and of its acetyl derivative, appeared to indicate that the substance in question was a dihydric alcohol possessing the formula $C_{23}H_{38}O_2(OH)_2$. It has since been observed, however, that the analytical results agree equally well for a higher formula, $C_{29}H_{47}O_2(OH)_3$. The present authors have recently analysed benzoylipuranol, when figures were obtained which were not in harmony with the formula



but were in exact agreement with those theoretically required for the tribenzoyl derivative of a substance possessing the higher formula mentioned above. In the following table the theoretical analytical figures for the two formulæ are compared:

	$C_{23}H_{38}O_2(OH)_2$.	$C_{29}H_{47}O_2(OH)_3$.
Required for alcohol.....	C=72·6; H=10·5.	C=72·8; H=10·5.
„ „ acetyl derivative ...	C=69·8; H= 9·5.	C=69·5; H= 9·2.
„ „ benzoyl derivative ...	C=75·5; H= 8·2.	C=76·0; H= 7·8.

A molecular-weight determination of the acetyl derivative was subsequently made, when the value 607 was obtained, compared with 604 required for $C_{29}H_{47}O_5(CO \cdot CH_3)_3$ and 464 required for $C_{23}H_{38}O_4(CO \cdot CH_3)_2$. It is thus evident that ipuranol is a trihydric alcohol, possessing the formula $C_{29}H_{47}O_2(OH)_3$.

Similarly, it has been ascertained that cluytanol possesses the formula $C_{29}H_{46}O(OH)_4$, and not $C_{23}H_{37}O(OH)_3$, as recently stated (this vol., p. 265).

Power and Moore (*Trans.*, 1910, **97**, 102) described the isolation from colocynth of a new alcohol, designated as citrullol, which appeared to possess the formula $C_{22}H_{36}O_2(OH)_2$, thus being a lower homologue of ipuranol. A small quantity of this substance being available, it has now been re-investigated, with the result that it has been ascertained that citrullol should be represented by the formula $C_{28}H_{45}O_2(OH)_3$, a conclusion which is quite in harmony with the analytical results obtained by Power and Moore. The citrullol examined was analysed, with the following result:

0·0923 gave 0·2448 CO_2 and 0·0859 H_2O . C=72·3; H=10·3.

$C_{28}H_{48}O_5$ requires C=72·4; H=10·3 per cent.

Power and Moore found C=72·1; H=10·4 per cent.

A molecular-weight determination of the acetyl derivative yielded the following result:

0·4019 in 23·96 benzene gave $\Delta t = 0·13^\circ$. M.W.=613.

$C_{34}H_{54}O_3$ requires M.W.=590. $C_{28}H_{42}O_6$ requires M.W.=450.

Benzoylcitrullol has not previously been described. It forms colourless needles, melting at 179—180°:

0·0947 gave 0·2640 CO_2 and 0·0650 H_2O . C=76·0; H=7·6.

$C_{40}H_{60}O_8$ requires C=75·8; H=7·6 per cent.

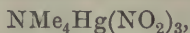
$C_{36}H_{46}O_6$ „ C=75·2; H=8·0 „ „

In view of these results it would appear probable that some, at least, of the other alcohols related to ipuranol which have been isolated may possess higher formulæ than those at present ascribed to them, but material for their re-investigation is not now available.

318. "Molecular conductivity and ionisation of nitrites."

By Prafulla Chandra Rây and Nilratan Dhar.

Twenty-three nitrites have been studied from the point of view of their electrical conductivity and hydrolysis in aqueous solution. The nature of the complexes in the salts sodium mercurinitrite, $\text{Na}_2\text{Hg}(\text{NO}_2)_4$, tetramethylammonium mercurinitrite,



and mercuriosomercurinitrite, $\text{HgHg}_2(\text{NO}_2)_5$, has been determined.

The inadequacy of the expression $A_v/A_o = \mu$ was also discussed.

319. "The latent heats of chloroform and benzene and of their mixtures between 0° and 80°." By James Fletcher and Daniel Tyrer.

A method was described for accurately determining latent heats at constant composition of mixtures over a wide range of temperature. The latent heats of pure chloroform and pure benzene and mixture of these liquids of varying compositions have been determined between the ordinary temperature and the boiling points. It is found that for any given mixture the latent heat is a linear function of the temperature, and for a given temperature the latent heat is approximately a linear function of the composition.

320. "Synthetic aminoglucosides derived from *d*-glucosamine."

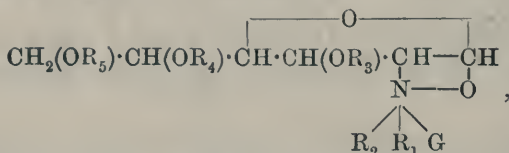
By James Colquhoun Irvine and Alexander Hynd.

It was shown that bromotriacetylglucosamine is a general reagent for the preparation of α -aminoglucosides, as it enters into reaction with widely different types of hydroxy-compounds, giving, in the first instance, acetylated aminoglucosides, from which the acyl groups may be removed by hydrolysis.

Both the acetylated and unsubstituted aminoglucosides thus obtained may be divided into two classes, which differ in their behaviour towards hydrolytic agents, and in their capacity to form molecular complexes with metallic haloids. Some of the compounds are remarkably stable, and are only hydrolysed to give glucosamine salts when strongly heated with concentrated acid. In such cases they are also unaffected by enzymes, and form additive compounds with silver iodide.

A second type of aminoglucoside is formed when the group combined with the glucosamine residue contains a benzene ring, as then hydrolysis with dilute mineral acids proceeds quite normally, and thus the usual glucosidic formulæ may be applied to the compounds. Representative members of this class are *α*-amino-benzylglucoside, *α*-aminohelicin, *α*-aminosalicin, and *α*-aminomorphineglucoside.

In many respects acetylated aminoglucosides show a remarkable similarity in their behaviour towards both acids and alkalis to the simpler glucoproteins. The suggestion was made that the latter compounds may be constituted in an analogous manner to triacetyl- α -aminomethylglucoside, and thus conform to the general structure:



where G stands for the "glucosidic" group, and R₁, R₂, etc., for amino-acyl residues. Syntheses of complexes of this nature are now being carried out.

Copyright © 2004 John Wiley & Sons, Ltd.

I. *Donations.*

Allmand, *Arthur John*. The principles of applied electrochemistry. London 1912. pp. xii + 547. ill. 18s. net. (*Recd.* 2/12/12.)

From the Publisher: Mr. Edward Arnold.

Barclay, *William R.*, and Hainsworth, *Cecil H.* Electroplating. A treatise on the electro-deposition of metals, with a chapter on metal-colouring and bronzing. London 1912. pp. viii + 399. ill. 7s. 6d. net. (*Recd.* 2/12/12.)

From the Publisher : Mr. Edward Arnold.

Makower, W., and Geiger, H. Practical measurements in radio-activity. London 1912. pp. ix + 151. ill. 5s. net. (*Recd.* 23/11/12.)

From the Publishers: Messrs. Longmans, Green & Co.

Martin, Geoffrey, [and others]. Industrial and manufacturing chemistry. Organic. London [1912]. pp. xx+726. ill. 21s. net. (*Recd.* 3/12/12.)

From the Publishers: Messrs. Crosby, Lockwood & Son.

Mellor, Joseph William. Modern inorganic chemistry. London 1912. pp. xx+871. ill. 7s. 6d. (*Recd.* 23/11/12.)

From the Publishers: Messrs. Longmans, Green & Co.

Norton, Thomas H. Utilization of atmospheric nitrogen. (U.S. Dept. Commerce and Labor. Bureau of manufactures. Special Agents Series, No. 52.) Washington 1912. pp. 178. ill. (*Recd.* 20/11/12.)

From the Author.

Price, Thomas Slater. Per-acids and their salts. London 1912. pp. iv+123. 3s. net. (*Recd.* 23/11/12.)

From the Publishers: Messrs. Longmans, Green & Co.

Russell, Edward John. Soil conditions and plant growth. London 1912. pp. viii+168. 5s. net. (*Recd.* 23/11/12.)

From the Publishers: Messrs. Longmans, Green & Co

II. *By Purchase.*

Cohen, Ernst. Jacobus Henricus van't Hoff. Sein Leben und Wirken. Leipzig 1912. pp. xv+638. ill. M. 16.—. (*Recd.* 30/11/12.)

Thorpe, Sir Edward. A dictionary of applied chemistry. Vol. III. London 1912. pp. viii+789. ill. £2 5s. net. (*Recd.* 30/11/12.)

ERRATUM.

PROCEEDINGS, 1912.

Page 238, line 22, for "COPh·COPh·NPh·CO₂Et" read "COPh·CHPh·NPh·CO₂Et."

At the next Ordinary Scientific Meeting on Thursday, December 19th, 1912, at 8.30 p.m., the following papers will be communicated:

"Dibenzyl- and diphenyl-silicols and silicones." By G. Martin.

"An attempt to harmonise the relation between temperature and rotation for light of all refrangibilities of certain active substances, both in the homogeneous state and in solution." By T. S. Patterson.

"The photography of absorption spectra." By T. R. Merton.

"The constitution of ortho-diazoimines. Part II. The *p*-tolyl-naphthatriazoles." By G. T. Morgan and F. M. G. Micklethwait.

"Co-ordination compounds of vanadium. Part I. The acylacetones." By G. T. Morgan and H. W. Moss.

"Optically active glycols derived from the phenyl-lactic acids. Part I." By A. McKenzie and G. Martin.

"Diphenylene. Part II." By J. J. Dobbie, J. J. Fox, and A. J. H. Gauge.

"A new method for the estimation of hypochlorites." By H. G. Williams.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 28

No. 408.

Thursday, December 19th, 1912, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. Ridsdale Ellis, E. L. Lomax, C. E. Sladden, John W. Patterson, and E. A. Cooper were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

John Hugh Christie, B.Sc., c/o Dr. Bean, Cross Gates, Leeds.

Roland Doumin, 76, Tannsfeld Road, Sydenham, S.E.

Albert Edward Garrett, B.Sc., Yaverland, Clarence Road, St. Albans.

Douglas Henville, 67, Glencoe Street, Newington, Hull.

Thomas James Kirkland, B.Sc., Hereward Hall, Ely.

William Norman Rae, B.A., Royal College, Colombo, Ceylon.

Hermann Horace Roskin, B.Sc., 11, Newlands Road, Middlesbrough.

William Slessor Simpson, M.A., B.Sc., Dynamite Factory, Somerset West, S. Africa.

Of the following papers, those marked * were read:

- *321. "A qualitative attempt to harmonise the relation between temperature and rotation for light of all refrangibilities of certain active substances, both in the homogeneous state and in solution." By Thomas Stewart Patterson.

Evidence was adduced to show that the temperature-rotation curve for an active substance is probably irregularly periodic, and that in comparing the rotation values for different substances of a similar class account should be taken of something corresponding with phase and something corresponding with amplitude. The influence of a solvent appears to be to shift the temperature-rotation curve as a whole towards a lower or higher temperature with corresponding difference in amplitude. The maximum rotation occurs at slightly different temperatures for light of different refrangibilities, and this accounts for the phenomenon of anomalous rotation-dispersion. The influence of solvents on anomalous rotation-dispersion appears to be just the same as on the temperature of maximum rotation. The recognition of the variation of the temperature of maximum rotation appears to bring into one general scheme all the diverse phenomena of optical activity.

DISCUSSION.

The PRESIDENT said that in all the six cases in which he himself had found a maximum rotation* the latter occurred at a temperature below the melting point of the substance. He suggested that the maximum in such cases might be associated with the complex condition of the liquid in the supercooled state in which two or more different kinds of molecules might be present. Some of the maxima recorded by Dr. Patterson appeared to him to have been obtained at temperatures so high that some decomposition might be feared, but he presumed that the author had taken the possibility of a spurious maximum being thus obtained into consideration.

In reply to the President, Dr. PATTERSON stated that the maxima observed in the temperature-rotation curves was not due in any way to decomposition of the substances on heating. In cooling from a high temperature the rotation was observed to rise and then diminish again.

* Ethyl dibenzoyltartrate, ethyl and methyl di-*o*-toluoyltartrates, methyl di-*o*-chloro-, di-*o*-bromo-, and di-*o*-iodo-tartrates.

*322. "The photography of absorption spectra."

By Thomas Ralph Merton.

The photographic methods generally used for the observation of absorption spectra are not suitable for quantitative investigations owing to the complicated conditions which govern the density of a photographic plate.

A photographic method has been found for the determination of extinction curves which is free from these objections.

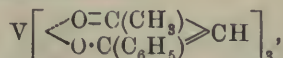
*323. "The constitution of ortho-diazoimines. Part II. The *p*-tolynaphthatriazoles." By Gilbert T. Morgan and Frances Mary Gore Micklethwait.

In continuation of earlier experiments (*Proc.*, 1910, 26, 151), attempts have been made to prepare the third isomeride, having the general formula $\alpha\beta\text{-C}_{10}\text{H}_6\text{:N}_3\text{C}_7\text{H}_7(p)$.

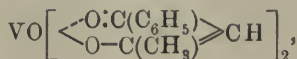
2:4-Dinitro-1-*p*-tolyl- α -naphthylamine (yellow needles, m. p. 196—198°), obtained by boiling 1-chloro-2:4-dinitronaphthalene and *p*-toluidine in xylene solution, yielded on complete reduction the somewhat oxidisable base 1-*p*-tolyl-1:2:4-triaminonaphthalene (colourless needles, m. p. 177°). The action of nitrous acid on this triamine is remarkable, as it leads to the elimination of *p*-toluidine, in the form of *p*-toluenediazonium chloride, and to the production of 2-amino-1:4-naphthaquinoneimide, a compound hitherto obtained by the action of ferric chloride on 2:4-diamino- α -naphthol. The partial reduction of 2:4-dinitro-1-*p*-tolyl- α -naphthylamine is under investigation.

*324. "Co-ordination compounds of vanadium. Part I. The acyl-acetonates." By Gilbert T. Morgan and Henry Webster Moss.

Vanadium terbenzoylacetate,

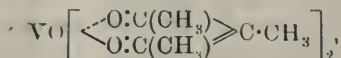


dark chocolate-brown leaflets, m. p. 218—220°, was obtained by the interaction of anhydrous vanadium trichloride, benzoylacetone, and alcoholic sodium ethoxide; it is insoluble in water, and dissolves freely in chloroform or benzene. In the moist condition it oxidises to the emerald-green *vanadium oxybisbenzoylacetate* (*vanadyl bisbenzoylacetate*),



which is more readily prepared by dissolving freshly precipitated vanadyl hydroxide in an alcoholic solution of benzoylacetone.

Vanadium oxybisacetylmethylacetone (*vanadyl bisacetylmethylacetone*),



sage-green, acicular prisms, results from the interaction of vanadyl hydroxide and alcoholic acetylmethylacetone.

The ultra-violet absorption spectra of the vanadium teracylacetones and vanadium oxybisacylacetones in alcoholic solution differ from those of vanadium trichloride and vanadyl dichloride in showing persistent absorption bands like the bands exhibited by the acylacetones themselves, whereas the two chlorides indicate only general absorption in dilute solutions.

325. "Dibenzyl- and diphenyl-silicols and -silicones."

By Geoffrey Martin.

The author, by means of a tabular comparison between the compounds recently described by Kipping (*Trans.*, 1912, 101, 2108 *et seq.*) and the same ones previously described by himself (*Ber.*, 1912, 45, 403), controverted Kipping's statement (*loc. cit.*) that an erroneous account has been given of these compounds. The author pointed out that he had not described any "isomeric" diphenylsilicols in his paper (*loc. cit.*), as asserted by Kipping, and stated that Kipping had merely "rediscovered" the two modifications of diphenylsilicol described by him ten months previously (*loc. cit.*). The author maintained the correctness of his conclusion that one modification can pass into the other, and vice versa. He pointed out that Kipping himself records the passage of one modification into the other, and actually states that it is a result "which appears to be fully established" (*loc. cit.*, p. 2124).

326. "Optically active glycols derived from the phenyl-lactic acids.

Part I." By Alex. McKenzie and Geoffrey Martin.

The authors have prepared and examined a number of glycols derived from esters of β -hydroxy- β -phenylpropionic acid and α -hydroxy- β -phenylpropionic acid respectively by the application of Grignard reagents.

327. "Diphenylene. Part II." By James Johnston Dobbie, John Jacob Fox, and Arthur Josiah Hoffmeister Gauge.

Certain derivatives of diphenylene, $C_6H_4:C_6H_4$ (*Trans.*, 1911, **99**, 683), have been prepared. A *dibromodiphenylene* melting at 171° was obtained by the action of bromine on the hydrocarbon, but at the same time a considerable amount of 2:2'-dibromodiphenyl was formed.

Nitration with a mixture of concentrated sulphuric acid and nitric acid (D 1.5) resulted in the formation of a *tetranitrodiphenylene* melting at 223° .

When diphenylene was heated with diluted nitric acid under pressure, there were formed: (1) a *dinitrodiphenylene* melting at 204° , (2) *diphenylene oxide*, (3) 3-nitrophthalic acid. In preparing the derivatives of diphenylene, a large proportion of the parent substance was invariably converted into waxy and resinous substances.

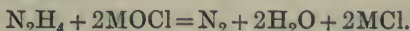
Attempts to prepare diphenylene by other methods than that originally employed were described. Dry distillation of silver diphenate led to the formation of the lactone of 2-hydroxydiphenyl-2'-carboxylic acid, $\begin{matrix} C_6H_4 \cdot C(=O) \\ | \\ C_6H_4 \cdot O \end{matrix}$, but no diphenylene was formed.

Finely-divided sodium reacted rapidly with 2:2'-dibromodiphenyl, forming diphenylene and other substances, of which one agreed in composition with the formula $C_{84}H_{66}Br_2$, and melted at 306° .

328. "A new method for the estimation of hypochlorites."

By Herbert Goulding Williams.

Hypochlorites can be titrated with a *N*/10-solution of hydrazine sulphate, the end point being determined by starch-iodide paper. The action appears to be:



It is necessary to keep the mixture alkaline throughout, sodium hydrogen carbonate being added if required. Comparison titrations made with *N*/10-arsenic trioxide and *N*/10-hydrazine sulphate showed very close agreement.

The author finds that, contrary to the statement of Browne and Shetterly, neither ammonia nor azoimide is formed.

329. "Ethylation in the flavone group."

By Arthur George Perkin.

Although, except in the case of myricetin, fully ethylated derivatives of flavone colouring matters containing an hydroxyl adjacent to the carbonyl group have not hitherto been prepared by means of ethyl iodide and alkali, no difficulty exists in producing such compounds if an excess of the reagents is employed. Adopting the procedure found serviceable with myricetin (*Trans.*, 1911, **99**, 1725), luteolin (5 grams) gave *luteolin tetraethyl ether*, $C_{15}H_6O_2 \cdot (OEt)_4$ (Found, Et=28.67), colourless needles, m. p. 153—155° (4 grams), whereas from apigenin (5 grams), *apigenin triethyl ether*, $C_{15}H_7O_2 \cdot (OEt)_3$ (Found, Et=24.58), prismatic needles, m. p. 189—191° (4 grams), was prepared. Quercetin from rutin (10 grams) yielded *quercetin pentaethyl ether*, $C_{15}H_5O_2(OEt)_5$, colourless, prismatic needles, m. p. 116—118° (11 grams) (Found, Et=32.86; C=67.70; H=6.78), and when hydrolysed with alcoholic potassium hydroxide gave protocatechuic acid diethyl ether, and the hydroxyfisetol triethyl ether, $C_{14}H_{20}O_5$, m. p. 96—97° (Found, C=62.79; H=7.39), previously obtained (*loc. cit.*) from myricetin hexaethyl ether. The low melting point of the quercetin pentaethyl ether suggests that this compound may prove to be dimorphous. In a similar way quercetagenin and gossypetin give fully ethylated derivatives, which will be described in a later communication, and there is evidence that other analogous ketonic compounds behave similarly under this treatment.

330. "The synthesis of some new dimethyltetrahydroquinolines."

By Arthur James Ewins and Harold King.

The synthesis of 4:8-dimethyl-1:2:3:4-tetrahydroquinoline and of the corresponding 4:7- and 4:6-dimethyl bases from the *o*-, *m*-, and *p*-toluidides of acetoacetic acid has been carried out in order to compare their properties with those of a base, α -cystisolidine, a degradation product of the alkaloid cytisine (Freund, *Ber.*, 1904, **37**, 16).

The above-mentioned toluidides have not hitherto been isolated. They were prepared by heating mixtures of the toluidine and ethyl acetoacetate, in molecular proportions, to boiling for one to one and a-half minutes. On cooling, the nearly pure toluidides separate out in good yield. On treatment with sulphuric acid at 100° for fifteen minutes they yield carbostyrils, and the latter, by reduction with sodium in alcoholic solution, the dimethyltetrahydroquinolines.

331. "The constitution of cytisine, the alkaloid of *Cytisus laburnum*.Part I. The synthesis of α -cytisolidine and of β -cytisolidine."

By Arthur James Ewins.

By the action of hydriodic acid and phosphorus on cytisine, $C_{11}H_{14}ON_2$, at a temperature of 225—230°, Freund (*Ber.*, 1904, **37**, 16) obtained among other products a feebly basic, crystalline solid, cytisoline, $C_{11}H_{11}ON$ (m. p. 198°), and a strongly basic oil, β -cytisolidine, to which he gave the formula $C_{11}H_{15}N$. Cytisoline, on reduction with sodium in alcoholic solution, gave a strongly basic oil of the composition $C_{11}H_{15}N$, which was termed α -cytisolidine on account of its supposed isomerism with β -cytisolidine.

The constitutions of these two bases have now been established by their synthesis. α -Cytisolidine is identical with 6:8-dimethyl-1:2:3:4-tetrahydroquinoline ($C_{11}H_{15}N$), and β -cytisolidine with the corresponding 6:8-dimethylquinoline ($C_{11}H_{11}N$). The formula assigned to β -cytisolidine by Freund is thus inaccurate.

The relationship of the bases obtained by Freund must therefore be as follows:

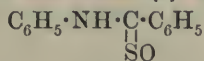
Cytisoline, $C_{11}H_{11}ON$	(?)-Hydroxy-6:8-dimethylquinoline.
β -Cytisolidine, $C_{11}H_{11}N$	6:8-Dimethylquinoline.
α -Cytisolidine, $C_{11}H_{15}N$	6:8-Dimethyl-1:2:3:4-tetrahydroquinoline.

The constitution of cytisine, from which cytisoline is formed merely by the elimination of the elements of ammonia, remains undetermined.

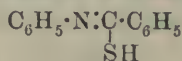
332. "Some reactions of the sulphylic acids."

By Percy May and Samuel Smiles.

Barnett and Leete (*Proc.*, 1911, **27**, 120) have shown that when thiobenzanilide is oxidised with hydrogen dioxide the corresponding thionyl derivative (I) is formed. When it is considered that

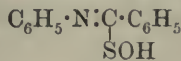


(I.)



(II.)

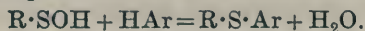
thiobenzanilide and other thioamides exhibit in many of their reactions the structure of an imino-mercaptan (for example, II), it seems probable that the oxide in question would behave in a similar manner according to the isomeric formula represented by (III). The suspicion is confirmed by the fact that thiobenzanilide



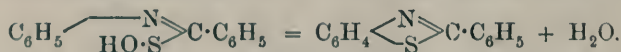
(III.)

oxide yields a sodium salt, for there can be no doubt that in this substance the metal is attached to the thionyl group. It is therefore evident that under certain conditions thiobenzanilide oxide may be regarded as a sulphylic acid, and at the time when this investigation was planned only one other substance of this class, namely, formaldehyde sulphylic acid, had been isolated. The temporary existence of these substances in certain reactions has been frequently postulated with varying degrees of certainty, and opportunity has now been taken to test the accuracy of certain assumptions concerning their reactivities. Fromm and his collaborators (*Ber.*, 1908, **41**, 3397; 1909, **42**, 3816) have advanced the view that in alkaline solution the sulphylic acids are unstable, and tend to undergo simultaneous reduction and oxidation, mercaptans and various products of oxidation being formed. This is fully confirmed by the behaviour of thiobenzanilide oxide in alkaline solution. The sodium salt may be obtained by rapidly cooling a warm solution of the substance in 10 per cent. aqueous sodium hydroxide; it forms very pale yellow needles, which are soluble in cold water, but sparingly so in the cold alkaline medium. The salt is not stable, and if the aqueous solution is warmed it is completely decomposed, yielding benzanilide and thiobenzanilide. It is clear that the latter is formed by reduction of the oxide, and independent experiment shows that the former product is obtained when the oxide is treated with alkaline oxidising agents.

In explaining the reactions of disulphides with concentrated sulphuric acid, it has also been postulated (Prescott and Smiles, *Trans.*, 1911, **99**, 642) that the sulphylic acids are capable of condensing in that medium with an aromatic nucleus yielding sulphides, for example:



Support is given to this assumption by the fact that thiobenzanilide oxide is almost quantitatively transformed by warm sulphuric acid into the phenylbenzothiazole, which has been previously obtained (for example, *Ber.*, 1886, **19**, 1068) in other ways:



Among other reactions of this oxide mention may be made of that which takes place with dry hydrogen chloride in presence of a dehydrating agent; sulphur is eliminated, and the iminochloride of benzanilide is formed as expressed by the following equation:



The further investigation has been abandoned owing to the recent

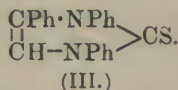
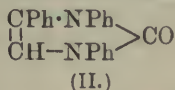
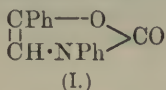
discovery (*Ber.*, 1912, **45**, 2965) of other sulphylic acids of less intricate structure.

333. "The condensation of α -keto- β -anilino- α -phenylethane and its homologues with carbonyl chloride, phenylcarbimide, and phenylthiocarbimide." By Hamilton McCombie and Harold Archibald Scarborough.

McCombie and Parkes (*Trans.*, 1912, **101**, 1991) have shown that carbonyl chloride and α -keto- β -anilino- $\alpha\beta$ -diphenylethane can be condensed to give 3:4:5-triphenyl-2:3-dihydro-2-oxazolone. This synthesis has now been extended to α -keto- β -anilino- α -phenylethane, which with carbonyl chloride gives 3:5-diphenyl-2:3-dihydro-2-oxazolone (I). This reaction has been applied also to compounds in which aniline has been replaced by *o*-, *m*-, and *p*-toluidine and β -naphthylamine.

These oxazolones are stable compounds, and their basicity is so slight that no picrates or hydrochlorides could be isolated.

Brazier and McCombie (*Trans.*, 1912, **101**, 2352) acted on α -keto- β -anilino- $\alpha\beta$ -diphenylethane with phenylcarbimide, and obtained 1:3:4:5-tetraphenyl-2:3-dihydro-2-glyoxalone. This reaction has now been extended to α -keto- β -anilino- α -phenylethane, which gives with phenylcarbimide, 1:3:4-triphenyl-2:3-dihydro-2-glyoxalone (II). The reaction occurs in two stages; the two compounds are heated together on a water-bath until a white mass is obtained, which on treatment with alcoholic hydrogen chloride yields the glyoxalone; the corresponding *o*-, *m*-, and *p*-toluidine and β -naphthylamine compounds have been obtained:



The glyoxalones yield salts with picric acid, but not with hydrochloric acid. These picrates consist of one molecule of the base combined with one molecule of the acid.

Phenylcarbimide has been replaced by phenylthiocarbimide yielding 1:3:4-triphenyl-2:3-dihydro-2-glyoxalthione (III).

334. "Note on the nitration of *p*-hydroxyacetophenone."

By Frank Geo. Pope.

Gattermann (*Ber.*, 1892, **25**, 3523) obtained 3-nitro-*p*-hydroxyacetophenone in small yield (11 per cent.) by the condensation of *o*-nitroanisole with acetyl chloride in the presence of aluminium chloride. It crystallises in yellow needles melting at 130.5°. The

position of the nitro-group was determined by oxidising the methyl ether with dilute nitric acid to 3-nitroanisic acid, which had already been obtained by Salkowski.

Since the hydroxy-ketone is merely a *p*-substituted phenol, there appeared to be no reason why nitration should not be directly attempted, and the following experiment was consequently carried out.

3.5 Grams of the finely-powdered hydroxy-ketone were added in small quantities at a time to a well-cooled mixture of 20 c.c. of nitric acid (D 1.42) and 20 c.c. of concentrated sulphuric acid, with constant stirring. After half an hour the mixture was poured on to crushed ice, and the faintly yellow precipitate was collected, well washed, and dried. The amount of solid matter so obtained was 3.5 grams, and in the crude state melted at 128—130°. This represents a 75 per cent. yield of nitrohydroxyacetophenone.

The nitro-compound was then crystallised from boiling water, separating in slender, yellow needles, melting at 135°. (Found, N=7.92. $C_8H_7O_4N$ requires N=7.73 per cent.)

Hence the nitro-compound is 3-nitro-*p*-hydroxyacetophenone, and further proof is given by the fact that on methylation and subsequent oxidation with dilute nitric acid, 3-nitroanisic acid is obtained. The acid prepared in this manner melts sharply at 190—191°, whereas Salkowski gives 186—187°.

The methyl ether which was also obtained simultaneously by Gattermann is readily prepared by methylating *p*-hydroxyacetophenone in alkaline solution with methyl sulphate, and then nitrating the methyl ether in the manner described above. On oxidation with dilute nitric acid it also yields 3-nitroanisic acid (m. p. 190—191°), a mixed specimen of the acid as obtained by the two different methods also giving the same melting point.

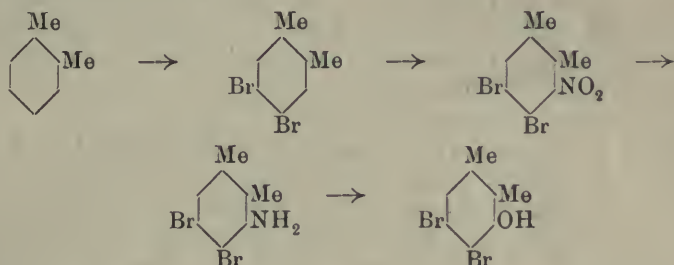
335. "Bromoxilenols obtained from dimethyldihydroresorcin. (Preliminary note.)" By Arthur William Crossley and Sydney Smith.

In 1903 Crossley and Le Sueur (*Trans.*, 1903, **83**, 110) described experiments on the action of phosphorus haloids on dimethyldihydroresorcin, and showed that both with phosphorus pentachloride and especially phosphorus pentabromide, the resulting substances readily undergo transformation into aromatic derivatives, giving in the latter case bromoxilenols. There were described a monobromoxilenol melting at 83.5—84° and a dibromoxilenol melting at 96.5°. Both these substances gave on treatment with bromine a tribromoxilenol melting at 183°, which, it was suggested, might

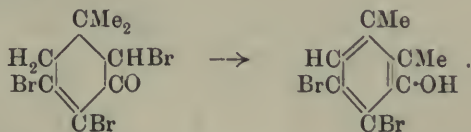
be identical with tribromo-*o*-3-xyleneol melting at 184°. A second tribromoxyleneol was encountered, melting at 177°.

Further work has shown that the reactions are very complicated and susceptible to the slightest variation in experimental conditions. Although by no means complete, it is considered desirable to place on record a brief summary of the definite results so far obtained, as the present authors are unable to continue the work conjointly.

(1) The monobromoxyleneol, m. p. 84°, and the dibromoxyleneol, m. p. 96.5°, have been proved to be derivatives of *o*-3-xyleneol; and although the position of the bromine atom in the former has not yet been decided, the latter has been proved by synthesis to be 4:5-dibromo-*o*-3-xyleneol. The synthetic formation is indicated by the following formulæ:



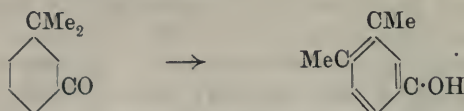
(2) 4:5-Dibromo-*o*-3-xyleneol has also been obtained by the action of heat or of alcoholic potassium hydroxide on 2:4:5-tribromo-1:1-dimethyl- Δ^4 -cyclohexen-3-one (tribromoketodimethyltetrahydrobenzene) (*ibid.*, p. 124), its formation by loss of hydrogen bromide necessitating the wandering of a methyl group from carbon atom 1 to carbon atom 2:



(3) There has been isolated from the action of phosphorus pentabromide on dimethyldihydroresorcin a monobromoxyleneol melting at 103°. Although the constitution of this substance has not been proved by synthesis, it would appear to be a derivative of *o*-4-xyleneol, because on further treatment with bromine it gives a tribromoxyleneol, and from this an acetyl derivative, the melting points of which are not lowered on admixture respectively with tribromo-*o*-4-xyleneol and its acetyl derivative.

In this rearrangement, therefore, a methyl group has again

wandered into an ortho-position but from carbon atom 1 to carbon atom 6, instead of carbon atom 2:



The work is being continued, and it is hoped shortly to communicate more detailed accounts of these transformations and of the nature of the resulting products, for which purpose the synthesis of a number of bromoxylenols is being carried out.

336. "Non-aromatic diazonium salts. (Preliminary note.)"

By Gilbert T. Morgan and Joseph Reilly.

The authors have investigated the degree of diazotisability of the following partly aromatic and non-aromatic amines: 4-aminoantipyrine, 6-amino-2:4-dimethylpyrimidine, 4-amino-3:5-dimethylpyrazole, 4-amino-1:3:5-trimethylpyrazole, 2-amino-6-oxypurine (guanine), and aminomethyltriazole.

When 4-aminoantipyrine hydrochloride is diazotised with ethyl nitrite in alcoholic solution without excess of mineral acid an uncrystallisable, resinous product is obtained on concentrating the solution. With excess of acid a crystalline diazonium *hydrochloride* is produced, which after prolonged drying in a vacuum over potassium hydroxide corresponds with the formula $2\text{C}_{11}\text{H}_{11}\text{ON}_4\text{Cl}, \text{HCl}$. The *platinichloride*, $(\text{C}_{11}\text{H}_{11}\text{ON}_4)_2\text{PtCl}_6$, the *aurichloride*,



and the very explosive *dichromate*, $(\text{C}_{11}\text{H}_{11}\text{ON}_4)_2\text{Cr}_2\text{O}_7$, have the normal composition.

Although possessing a chemical constitution closely allied to the aromatic amines, 6-amino-2:4-dimethylpyrimidine is not diazotisable under the ordinary experimental conditions, and prolonged treatment with nitrous acid leads to the formation of the corresponding 6-hydroxy-2:4-dimethylpyrimidine.

4-Amino-3:5-dimethylpyrazole gives rise to diazonium salts as stable as those of 4-aminoantipyrine, and these substances are being investigated, together with those of 4-amino-1:3:5-pyrazole.

2-Amino-6-oxypurine does not diazotise under conditions which readily give rise to diazonium salts in the case of aminomethyltriazole.

The next Ordinary Scientific Meeting will be held on Thursday, January 23rd, 1913, at 8.30 p.m.

PROCEEDINGS
OF
THE CHEMICAL SOCIETY.

Vol. XXIX. Nos. 409—422
JANUARY—DECEMBER, 1913.

LONDON:
GURNEY & JACKSON, 33, PATERNOSTER ROW.
1914.

RICHARD CLAY AND SONS, LIMITED
BRUNSWICK ST., STAMFORD ST., S.E., AND
BUNGAY, SUFFOLK.

LIST OF GRANTS MADE FROM THE RESEARCH FUND
DURING THE YEAR 1913.

- £5 to F. W. Atack : experiments on salt formation of oximes.
- £5 to E. G. Bainbridge : reaction between sodium ethoxide and ethylene glycol diacetate.
- £5 to E. G. Bainbridge : preparation of glycols (continued).
- £5 to W. C. Ball : (a) complex derivatives of nickel ; (b) action of thallium nitrite on the alkyl halides.
- £10 to G. Barger and J. W. Smith : formation of addition compounds between organic substances and iodine, with special reference to adsorption and residual valency.
- £5 to F. Barrow : optically active amines and amino-alcohols.
- £10 to J. L. Bentley and E. Dickenson : manganese-copper alloys.
- £10 to O. L. Brady : constitution of aconitine (continued).
- £10 to J. C. Cain : santalin, and the chemistry of the diphenyl derivatives (continued).
- £12 to F. D. Chattaway : polymorphism in hydrazides and anilides (continued).
- £5 to P. Chorley : reactions of ketones containing the group $>\text{CH}\cdot\text{CO}\cdot\text{CH}_2$.
- £3 to G. W. Clough : effect of inorganic salts on the rotation of solutions of tartaric acid and its derivatives.
- £8 to J. E. Coates : velocity of combination of gaseous nitric oxide and chlorine.
- £10 to J. B. Cohen : preparation of ring structures containing silicon.
- £5 to B. B. Dey : study of coumarin condensation, with special reference to acetone dicarboxylic acid.
- £5 to F. P. Dunn : stereoisomerism of the oximes.
- £5 to A. C. Dunningham : equilibria of partially miscible liquids (continued).
- £10 to F. E. Francis : investigation of certain nitrosoamines.
- £3 to J. B. Firth : sorption of gases by charcoal (continued).
- £10 to H. Garland : study of ancient Egyptian alloys.

- £5 to T. O. Gerard : preparation of the homologues of fumaric and itaconic acids.
- £5 to N. Hall : investigation of a new onolic lactone derived from phenyl pyruvic acid.
- £10 to E. Hope : conversion of β -gnoscopine into its optical isomers.
- £5 to J. E. Hynes : investigation of phenylisotetronic acid.
- £3 to T. C. James : additive compounds of Schiff's bases.
- £3 to Miss M. Jones : dynamics of the interaction of sodium ethoxide and phenyl toluenesulphonate and of similar reactions in the presence of catalysts.
- £6 to W. J. Jones : chemico-dynamical study of the addition of hydrogen cyanide to unsaturated organic compounds.
- £5 to H. D. Kay : absorption of iodine by charcoal.
- £7 to J. Kenner : reactions of derivatives of 2 : 2'-ditolyl (continued).
- £5 to H. Krall : guanidine, its salts and related bodies.
- £5 to H. M. Langton : (a) viscometric determination of transition points ; (b) surface tension of solutions of alkaline carbonates, phosphates, etc.
- £5 to F. R. Lankshear : formation of cyclic bases from aromatic imides.
- £5 to F. R. Lankshear : luminescence spectra of organic vapours.
- £5 to N. P. McClelland : resolution of substance of the type $R_1R_2C=CR_3R_4$.
- £7 to H. McCombie : chlorination of iodophenols.
- £7 to Mrs. I. S. Maclean : condensation of the higher fatty aldehydes with pyruvic acid.
- £10 to G. Martin : investigation of silicon compounds.
- £5 to B. S. Mellor : (a) synthesis of two monosubstituted 1 : 5-diketones ; (b) properties of some derivatives of β -hydroxy- α -alkylcrotonic esters.
- £7 to A. Parker : specific heats of gases at high temperatures.
- £5 to J. R. Partington : ratio of the specific heats of gases.
- £10 to A. G. Perkin : constitution of apigenin and other natural colouring-matters.
- £8 to W. R. Pratt : isomeric trinitro-derivatives of *m*- and *p*-xylenes.
- £8 to F. A. Royle : compounds allied to bicyclic terpenes and camphor.
- £10 to D. Segaller : influence of the solvent in chemical reactions (continued).
- £5 to H. K. Sen : condensation of mono- and di-ketones with phenols, etc.
- £5 to W. Sheldon : addition of hydrocyanic acid to derivatives of glutaconic and itaconic acids.
- £10 to N. V. Sidgwick : physical properties of *o*-, *m*-, and *p*-isomers.

- £15 to J. L. Simonsen and C. S. Gibson : constitution of bebeerine, etc.
£5 to J. A. Smythe : organic polysulphides (continued).
£5 to V. Steele : studies in mobile groups.
£5 to H. Stephen : *o*- and *p*-toluquinolines and their derivatives.
£5 to Miss D. C. Stiebel : esterification of cholesterol with fatty acids and their chlorides.
£10 to F. B. Thole : relation between viscosity and chemical constitution (continued).
£8 to C. K. Tinkler : effect of change of state on the colours of certain mixtures.
£3 to E. C. Williams : the velocity of effusion of gases.

Total amount granted during 1913 = £368, 0. 0.

LIST OF FELLOWS ELECTED DURING 1913

Name.	Proposed.	Elected.
Acland, Theodore William Gull	December 5th, 1912	February 20th.
Adam, Neil Kensington, B.A.	November 21st, 1912	February 20th.
Advani, Parmanand Mewaram, M.A., B.Sc.	June 5th, 1913.....	December 4th.
Askew, Richard Watson, B.A.	November 6th, 1913	" "
Badami, Sankar Rao B., M.A.	November 6th, 1913	" "
Bailey, Alan Milsom	June 19th, 1913	" "
Bate, Stanley Charles, B.Sc.	November 6th, 1913	" "
Bateman, Alan Hamilton	June 5th, 1913.....	" "
Batey, John Percy, M.Sc.Tech.	April 3rd, 1913	May 15th.
Battye, Horace George	February 20th, 1913	" "
Beath, William	January 23rd, 1913...	February 20th.
Berlein, Charles Maurice, B.A.	November 6th, 1913	December 4th.
Bicknell, Arthur, B.Sc.	" " "	" "
Biggart, William Love	April 17th, 1913.....	June 19th.
Bissett, Crellyn Colgrave, B.Sc.	November 21st, 1912.	February 20th.
Blackburn, George Frederick William ..	April 3rd, 1913	May 15th.
Blaxter, Augustus Pearce Llewellyn, B.A.	November 6th, 1913	December 4th.
Rose, Adhor Krishna	" " "	" "
Bramley, Arthur, B.Sc.	" " "	" "
Brearley, Arthur Joseph, B.A.	" " "	" "
Brier, Albert, M.Sc. ..	December 5th, 1912	February 20th.
Brooks, Archibald Joseph	May 1st, 1913	June 19th.
Burr, Percy Charles, B.Sc.	January 23rd, 1913...	February 20th.
Butler, George Bernard	June 19th, 1913	December 4th.
Cahen, Edward	February 6th, 1913	May 15th.
Campbell, Bertram, B.Sc.	November 6th, 1913	December 4th.
Campbell, Norman Phillips, B.A.	June 5th, 1913.....	" "
Carter, Frederick George	November 6th, 1913	" "
Caruth, Alexander	February 6th, 1913	May 15th.
Chowdry, Santi Pada	November 6th, 1913	December 4th.
Christie, John Hugh, B.Sc.	December 19th, 1912	February 20th.
Clark, Francis William	November 6th, 1913	December 4th.
Clotworthy, Harold Reginald Septimus, B.A., B.Sc.	January 23rd, 1913...	February 20th.
Cockshutt, John Albert, M.Sc.	January 23rd, 1913...	February 20th.
Coleman, Herbert Stoddard	November 6th, 1913	December 4th.
Coppin, Noël Guilbert Stevenson, M.Sc. ...	February 20th, 1913	May 15th.
Crutchley, Arthur Ernest ..	April 3rd, 1913	" "
Cutbush, Charles George	December 5th, 1912	February 20th.
Dalal, Vasanji Premji, M.A., B.Sc.	April 3rd, 1913	May 15th.
Davies, Daniel James, B.Sc.	November 21st, 1912	February 20th.
Davies, Harold	February 20th, 1913	May 15th.
Davies, William Rlys.	May 15th, 1913	June 19th.
Dix, Alfred Gilbert, B.Sc.	March 6th, 1913	May 15th.

Name.	Proposed.	Elected.
Doumin, Roland	December 19th, 1912	February 20th.
Drakeley, Thomas James, B.Sc.	November 6th, 1913	December 4th.
Drummond, Jack Cecil, B.Sc.	May 1st, 1913	June 19th.
Edmondson, James Henry	November 21st, 1912	February 20th.
Eldin, Mohamed Shams, B.Sc.	June 5th, 1913.....	December 4th.
Elliott, Thomas Lenton.....	December 5th, 1912	February 20th.
Evans, Ulick Richardson, B.A.	November 21st, 1912	" "
Freeman, Horace.....	May 1st, 1913	June 19th.
Fuller, Cyril Duncan	November 6th, 1913	December 4th.
Gair, Charles John Dickenson	November 6th, 1913	December 4th.
Garland, Herbert	March 6th, 1913	May 15th.
Garrett, Albert Edward, B.Sc.....	December 19th, 1912	February 20th.
Ghose, Tin Kari, B.A., L.M.S.....	January 23rd, 1913...	" "
Gibson, Stanton, B.Sc.	November 6th, 1913	December 4th.
Gilmour, Robert, B.Sc., Ph.D.	December 5th, 1912	February 20th.
Glenday, Roy Gonçalves, B.A.....	May 15th, 1913	June 19th.
Gray, George Watson.....	January 23rd, 1913...	February 20th.
Haber, Fritz	February 20th, 1913	May 15th.
Hargreaves, Richard, B.A.	November 6th, 1913	December 4th.
Hay, Alexander Houghton	June 19th, 1913	" "
Hebden, George Alfred	November 6th, 1913	" "
Henville, Douglas	December 19th, 1912	February 20th.
Hewitt, James Arthur, B.Sc.	December 5th, 1912	" "
Hill, Percy Wolmer	March 6th, 1913	May 15th.
Hodges, Richard Pendarves	November 6th, 1913	December 4th.
Hodsoll, Harold Edward Pollock	February 6th, 1913	May 15th.
Hollely, William Francis	November 6th, 1913	December 4th.
Holroyd, Thomas Arthur, B.Sc.	March 6th, 1913	May 15th.
Holt, William Joseph	December 5th, 1912	February 20th.
Howells, Alfred Leslie, B.Sc.	November 21st, 1912	" "
Hutchinson, James Joseph	May 1st, 1913	June 19th.
Hutchinson, Percy, B.Sc.....	April 3rd, 1913	May 15th.
Huxtable, Charles	June 5th, 1913.....	December 4th.
Hynd, Alexander, M.A., B.Sc.	November 6th, 1913	" "
Johnson, William, B.Sc.	" " "	" "
Jones, Harold Bramfield	" " "	" "
Jones, Hilton Ira	April 17th, 1913	May 15th.
Kanga, Darab Dinsha, M.A.....	February 20th, 1913	" "
Keller, Douglas Rayment, B.Sc.	February 6th, 1913...	May 15th.
Khan, Ghulam Rasul, B.Sc.....	November 6th, 1913	December 4th.
Kirkland, Thomas James, B.Sc.	December 19th, 1912	February 20th.
Kur, Emmanuel Francis.....	February 20th, 1913	May 15th.
Lawson, Joseph Stuart	April 3rd, 1913	" "
Lefebure, Victor, B.Sc.	May 15th, 1913	June 19th.
Leitch, Peter Thomas.....	November 21st, 1912	February 20th.
Leivesley, Sidney Oliver	November 6th, 1913	December 4th.
Lewis, William John	" " "	" "
Lloyd, Daniel William, B.Sc.	January 23rd, 1913	February 20th.
Lloyd, Harold Charles, B.Sc.	April 3rd, 1913	May 15th.

Name.	Proposed.	Elected.
Loynes, Walter Cyril.....	January 23rd, 1913	February 20th.
Lycett, Percival James	November 6th, 1913	December 4th.
Macbeth, Alexander Killen, M.A., B.Sc.	January 23rd, 1913	February 20th.
McCann, John Francis	March 6th, 1913.....	May 15th.
Marchant, Frank Clifford	November 6th, 1913	December 4th.
Macnaughtan, Duncan James	May 15th, 1913	June 19th.
Mahamadi, Ghulam Ali.....	April 17th, 1913	" "
Martin, Henry Stephen.....	January 23rd, 1913	February 20th
Maude, Aylmer Henry	" " "	" " "
Maxwell, Marius.....	May 1st, 1912	June 19th.
May, Joseph Horsnell	January 23rd, 1913...	February 20th.
Maynard, Harry Bertram	March 6th, 1913	May 15th.
Mehta, Bhaichand Anupchand, M.A.....	February 20th, 1913	" "
Miller, Arthur George Abraham, B.Sc. ...	February 6th, 1913...	" "
Mumford, Ernest Joseph	January 23rd, 1913...	February 20th.
Murphy, Paul	December 5th, 1912	" "
Naik, Kunerji Gosai, M.A., B.Sc.	November 6th, 1913	December 4th.
Naylor, Jonathan Harold, M.Sc.....	December 5th, 1912	February 20th.
Nichols, John Allen	November 6th, 1913	December 4th.
Nolan, Thomas Joseph, M.Sc.	November 21st, 1912	February 20th.
Oliver, Ralph Richard	April 17th, 1913	June 19th.
Pager, Ferrand	February 20th, 1913	May 15th.
Parker, Jonathan	January 23rd, 1913...	February 20th.
Pattison, John Thomas	November 6th, 1913	December 4th.
Phillips, Percy Bernard.....	May 1st, 1913	June 19th.
Pollard, Cornelius Theodore, B.Sc.	November 21st, 1912	February 20th.
Potter, Francis Martin, B.Sc.	February 20th, 1913	May 15th.
Pougnet, Julien Pierre Frédéric	March 6th, 1913	" "
Powell, Wilfrid Roberts, B.A.	November 6th, 1913	December 4th.
Pracy, Henry Edward Findlater	" " "	" "
Rae, William Norman, B.A.	December 19th, 1912	February 20th.
Rai, Kali Prosonuo, M.A.....	April 17th, 1913.....	May 15th.
Robinson, Arthur Samuel, B.Sc.....	February 20th, 1913.	" "
Rolfe, Benedict Hugh, M.A.	June 5th, 1913.....	December 4th.
Roskin, Hermann Horace, B.Sc.	December 19th, 1912	February 20th.
Ruffley, John Robert	April 3rd, 1913	May 15th.
Rusby, Reginald William	February 20th, 1913	" "
Sabhar, Hormusji Kharshedji, M.A.....	February 20th, 1913	May 15th.
Sastry, Sosale Garalapury, B.A.	February 6th, 1913...	" "
Saunders, William Gilbert	May 1st, 1913	June 19th.
Shrewsbury, Herbert Sutcliffe	April 3rd, 1913	May 15th.
Simpson, William Slessor, M.A., B.Sc. ...	December 19th, 1912	February 20th.
Smith, John Walter, B.Sc.	January 23rd, 1913...	" "
Smith, Montagu George.....	May 1st, 1913	June 19th.
Stansfield, William James.....	February 20th, 1913	May 15th.
Stott, Philip Howard.....	June 5th, 1913.....	December 4th.
Stuart, John McArthur.....	November 6th, 1913	" "
Sutcliffe, John Algernon Lucy	June 5th, 1913.....	" "
Taylor, Harold Frank	June 19th, 1913	" "

Name.	Proposed.	Elected.
Taylor, Harold Victor	December 5th, 1912	February 20th.
Tennant, Robert.....	November 6th, 1913	December 4th.
Thomas, Ebenezer Rees, M.Sc.....	May 1st, 1913.	June 19th.
Thompson, Percy James	December 5th, 1912	February 20th.
Thorne, Percy Cyril Lesley, B.A.	May 15th, 1913	June 19th.
Turner, Bertrand, B.Sc.	November 21st, 1912.	February 20th.
Turnill, Thomas Willoughby	December 5th, 1912	" "
Twomey, Jeremiah, M.Sc.....	May 15th, 1913	June 19th. "
Walker, Henry	November 6th, 1913	December 4th.
Walker, John Stewart	May 1st, 1913	June 19th.
Watson, Edwin Longstaff.....	" " " "	" " " "
Watson, Thomas.....	March 6th, 1913	May 15th.
Webb, Edward, B.Sc.	December 5th, 1912	February 20th.
Welch, Bertie Mandel	November 20th, 1913.	December 4th.
Williams, Cornelius, B.Sc.	April 17th, 1913.....	May 15th.
Wilson, Ernest John, M.A.	" " " "	June 19th.
Wilson, Siddons Siddons	November 21st, 1912	February 20th.
Winstanley, Thomas Harrison.....	February 6th, 1913...	May 15th.
Wood, Henry	November 6th, 1913	December 4th.
Wood, Hubert Rogers	January 23rd, 1913...	February 20th.
Wyver, Clifton	February 6th, 1913...	May 15th.
Young, Thomas Howard	May 15th, 1913	June 19th.
Young, William John, D.Sc., M.Sc.	April 3rd, 1913	May 15th.

LIST OF HONORARY AND FOREIGN MEMBERS ELECTED DURING 1913.

Dmitri Petrovitch Konovaloff	May 15th, 1913	June 5th.
Alfred Weiner	" " " "	" "

LIST OF FELLOWS DECEASED DURING 1913.

Name.	Elected.	Died.
*Adams, Matthew Algernon	February 15th, 1877 ...	April 29th, 1913.
Barret, Edward Louis	February 4th, 1869.....	1913.
*Bell, J. Carter	January 19th, 1865.....	July 1st, 1913.
*Bloxam, William Popplewell	December 20th, 1883 ...	December 26th, 1913.
Cantin, Angelo	June 21st, 1900	February 12th, 1912.
Claudet, Arthur Crozier.....	June 18th, 1902	January 17th, 1913.
Crossman, Tom	February 21st, 1895 ...	July 13th, 1913.
*Cundall, James Tudor	March 17th, 1887	July 24th, 1913.
Davidson, Joseph	May 18th, 1876	June 9th, 1913.
Deane, Leopold Mandeville	March 4th, 1886	July 26th, 1913.
Findon, Frank Standish	May 4th, 1905	March 3rd, 1913.
* ¹ Hartley, Sir Walter Noel.....	December 20th, 1866 ...	September 11th, 1913.
* ² Heron, John	June 15th, 1876	March 29th, 1913.
Hunter, John	February 1st, 1883	April 10th, 1913.
* ³ Lewkowitsch, Julius	February 16th, 1888 ...	September 16th, 1913.
* ⁴ Marshall, Hugh	February 6th, 1890.....	September 6th, 1913.
* ⁵ Matthey, George	May 3rd, 1870	February 14th, 1913.
Patchett, Isaac	April 21st, 1870	April 10th, 1913.
Pyc, Thomas Ebenezer	July 5th, 1906..	October 15th, 1913.
Roy, Mathura Goolab.....	June 21st, 1900	April 8th, 1913.
Sandberg, Christer Peter	March 3rd, 1870	December 4th, 1913.
Spencer, Walter Shelley.....	June 16th, 1887	May 16th, 1913.
Tate, William	May 15th, 1890	February 19th, 1913.
Wallace, Arthur	May 2nd, 1912	June 25th, 1913.

* Contributed to the Transactions.

¹ Ordinary Member of Council, 1877-1880 ; Vice-President, 1890-1893.

² Ordinary Member of Council, 1892-1893.

³ " " " " 1902-1903.

⁴ " " " " 1911-1913.

⁵ " " " " 1877-1879.

TITLES OF PAPERS COMMUNICATED TO THE SOCIETY
DURING 1913.

	Page in Pro- ceedings.	Page in Trans- actions.
<i>January 23rd.</i>		
1. The constituents of the rhizome and roots of <i>Caulophyllum thalictroides</i> . By Frederick Belding Power and Arthur Henry Salway.....	2	191
2. Iouisation and the law of mass action. By William Robert Bousfield.....	3	307
3. The character and cause of the blue fluorescence which develops in alkaline solutions containing quinol and sulphite on exposure to the air. By Thomas Cunningham Porter	4	—
4. The form of extinction curves: cobalt nitrate solutions. By Thomas Ralph Merton	4	249
5. The hydrolysis of ethylene glycol diacetate. (Preliminary note.) By Ernest Graham Bainbridge	4	—
6. The chemistry of the glutaconic acids. Part VII. The normal and labile forms of α -dimethylglutaconic acid and their reduction to <i>cis</i> - α -dimethylglutaric acid. By Jocelyn Field Thorpe and Arthur Samuel Wood	5	276
7. The influence of water on the partial pressure of hydrogen chloride above its alcoholic solutions. By William Jacob Jones, Arthur Lapworth, and Herbert Muschamp Lingford	5	252
8. Quinone-ammonium derivatives. Part II. Nitro-haloid, di-haloid, and azo-derivatives. By Raphael Meldola and William Francis Hollely	6	177
9. The chemical nature of some radionetive disintegration products. By Alexander Fleck	7	381
10. The action of ammonia and alkylamines on reducing sugars. By James Colquhoun Irvine, Robert Fraser Thomson, and Charles Scott Garrett	7	238
11. The chlorination of iodophenols. Part II. The chlorination of <i>o</i> -haloid derivatives of <i>p</i> -iodophenol. By George King and Hamilton McCombie.....	8	220
12. Quercetagenin. By Arthur George Perkin.....	9	209
13. Hydroxyquinolphthalein anhydride and hydroxyquinolbenzein. By Kedar Nath Ghosh and Edwin Roy Watson	9	—
14. 2 : 2'-Ditolyl-5 : 5'-dicarboxylic acid. By James Kenner and Ernest Witham	10	232
15. The carbonylferrocyanides. By Herbert Ernest Williams	10	—
16. The so-called disodium derivative of diethyl malonate. By Alexander Killen Macbeth and Alfred Walter Stewart	11	—

	Page in Pro- ceedings.	Page in Trans- actions.
17. $\alpha\delta$ -Derivatives of adipic and β -methyladipic acids; and the preparation of muconic and β -methylmuconic acids. By Henry Stephen and Charles Weizmann ...	14	269
18. The measurement of tryptic protein hydrolysis by determination of the tyrosine liberated. By Samuel James Manson Auld and Thomas Duncan Mosserop...	14	281
19. The interaction of iodine and thiocarbamide. By Hugh Marshall	14	—
<i>February 6th.</i>		
20. The presence of helium in the gas from the interior of an X-ray bulb. By Sir William Ramsay, K.C.B. ...	21	264
21. The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures. (Preliminary note.) By John Norman Collie and Herbert Sutton Patterson	22	—
22. Vanbel's supposed phenyldi-imine. By Martin Onslow Forster and John Charles Withers	24	266
23. The latent heat of vapours. (Preliminary note.) By Malcolm Percival Applebey and David Leonard Chapman	24	—
24. Derivatives of <i>o</i> -xylene. (Preliminary note.) By John Lionel Simonsen	26	—
25. The alkaloids of <i>Xanthoxylum brachyacanthum</i> . By Hooper Albert Dickinson Jowett and Frank Lee Pyman	26	290
26. The absorption spectra of simple aliphatic substances in solutions and as vapours. Part II. Unsaturated aldehydes and ketones. By John Edward Purvis and Nial Patrick McClelland	26	433
27. Phytin and phytic acid. (Preliminary note.) By George Clarke	27	—
28. The constituents of the oil of <i>Cydnus Indicus</i> . By Edwin Roy Watson	28	548
29. Vapour density of ammonium nitrate. (Preliminary note.) By Prafulla Chandra Rây and Sarat Chandra Jana	28	—
30. The solubility of sulphanilic acid and its hydrates. By James Charles Philip	28	284
31. Hexahydropyrimidine and its benzoyl derivatives. By Arthur Walsh Titherley and Gerald Eyre Kirkwood Branch	29	330
32. Condensation of ketones with phenols. By Hemendra Kumar Sen-Gupta	29	—
33. The reaction between ferric salts and thiosulphates. By John Theodore Hewitt and Gladys Ruby Mann...	30	324
34. Influence of acetylacetone on ionic reactions. By John Theodore Hewitt and Gladys Ruby Mann	30	—
35. Viscosity and association. Part IV. The viscosity of the aromatic amines. By Ferdinand Bernard Thole	32	317

	Page in Pro- ceedings.	Page in Trans- actions.
36. The influence of the constitution of tertiary bases on the rate of formation of quaternary ammonium salts. Part. I. By Ebenezer Rees Thomas	32	594
37. Some blue iron cyanogen compounds. By Herbert Ernest Williams	32	—
38. Some properties of carbon monoxide. By Richard William Merriman... ..	33	—
<i>February 20th.</i>		
39. The mode of combustion of carbon. By Thomas Fred Eric Rhead and Richard Vernon Wheeler.....	51	461
40. The interaction of bromine and the sulphides of β -naphthol. Part II. By Thomas Joseph Nolan and Samuel Smiles.....	53	340
41. The nomenclature of the rhamnose group and of other substances related to the aldohexoses. By Hugh Marshall	54	—
42. Some green iron cyanogen compounds. By Herbert Ernest Williams.....	54	—
43. Catalytic decomposition of hydrogen peroxide. By Gwen Dyer and Alice Barbara Dale.....	55	—
44. The decomposition of hydrogen peroxide by colloidal platinum. By Harold Llewelyn Bassett	56	—
45. The absorption spectra of substances containing labile hydrogen atoms. By Peter Joseph Brannigan, Alexander Killen Macbeth, and Alfred Walter Stewart	58	406
46. Researches on the constitution of physostigmine. Part II. The synthesis of 3-dimethylaminoacetyl-2-methylindole and 2- α -dimethylamino- γ -hydroxy-propylindole. By Arthur Henry Salway	59	351
47. Contributions to our knowledge of semicarbazones. Part II. The semicarbazones of mesityl oxide. By Forsyth James Wilson and Isidor Morris Heilbron ...	59	377
48. Oxidation of the nitro- <i>o</i> -xylenes with dilute nitric acid. By Charles Horne Warner	60	—
49. Phosphonium and ammonium iodides. By Alfred Holt and James Eckersley Myers	61	—
50. The phosphoric acids and some phosphates. By Alfred Holt and James Eckersley Myers	61	532
51. Optical activity and enantiomorphism of molecular and crystal structure. By Thomas Vipond Barker and James Ernest Marsh	62	837
52. Some double salts with acetone of crystallisation and the crystallisation of silver iodide, silver bromide, and cuprous iodide. By James Ernest Marsh and William Claude Rhymes	62	781
53. The relation between the absorption spectra of acids and their salts. By Robert Wright	63	528

	Page in Pro- ceedings.	Page in Trans- actions.
54. Synthetical experiments in the group of the <i>isoquinoline</i> alkaloids. Part III. The constitution of anhydro-cotarnineacetophenone, etc., together with an account of some new condensation products of cotarnine. By Edward Hope and Robert Robinson	63	361
55. The identification of ipuranol and some allied compounds as phytosterol glucosides. By Frederick Belding Power and Arthur Henry Salway.....	63	399
<i>March 6th.</i>		
56. Quinonoid salts of nitroanilines. By Arthur George Green and Frederick Maurice Rowe	66	508
57. The existence of racemic compounds in the liquid state. By Alec Duncan Mitchell and Clarence Smith	67	489
58. The vapour pressures of the lower alcohols and their azeotropic mixtures with water. Part I. Ethyl alcohol. By Richard William Merriman	68	628
59. The action of chlorine on thymol and on <i>m</i> -cresol. By Horace Leslie Crowther and Hamilton McCombie.	68	536
60. The nomenclature of sugar derivatives. By James Colquhoun Irvine	69	—
61. Partly methylated glucoses. Part I. ζ -Monomethyl glucose and $\gamma\zeta$ -trimethyl glucose. By James Colquhoun Irvine and James Patterson Scott	70	564
62. Partly methylated glucoses. Part II. $\beta\gamma$ -Dimethyl α -glucose and $\beta\gamma$ -dimethyl β -glucose. By James Colquhoun Irvine and James Patterson Scott	71	575
63. Perezone. By Frederic George Percy Remfry	72	1076
64. Polybromides in nitrobenzene solution. By Alfred Francis Joseph	72	1554
65. The action of $\alpha\gamma$ -dibromobutane on the sodium derivatives of ethyl acetoacetate and benzoylacetate. By Robert George Fargher and William Henry Perkin, jun.	72	—
66. The action of $\alpha\gamma$ -dibromobutane on the sodium derivative of ethyl malonate. By Gibbs Blackstock and William Henry Perkin, jun.	74	—
67. Studies on cyclic ketones. Part III. By Siegfried Ruhemann and Stanley Isaac Levy.....	74	551
68. The interaction of chlorine and hydrogen. The influence of mass. By David Leonard Chapman and Leo Kingsley Underhill	75	496
69. The behaviour of calcium and magnesium salts with soap solutions, and the determination of hardness of water. By Helen Masters and Henry Llewellyn Smith	76	992
70. Organic derivatives of bismuth. (Preliminary note.) By Frederick Challenger	76	—
71. The estimation of mercury as metal by the dry method. By Alexander Charles Cumming and John Macleod...	77	513

	Page in Pro- ceedings.	Page in Trans- actions.
72. Studies in the diphenyl series. Part IV. The absorption spectra of the two isomeric <i>o</i> -dinitrobenzidines. By John Cannell Cain, Alexander Killen Macbeth, and Alfred Walter Stewart	77	586
73. A novel method for resolving externally compensated amines: derivatives of <i>d</i> - and <i>l</i> -oxymethylene-camphor. By William Jackson Pope and John Read.	78	444
74. A new iron bacterium. By Ernest Moore Mumford.....	79	645
75. The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures. By John Norman Collie and Hubert Sutton Patterson	79	419
76. The double platinic and cupric iodides of substituted ammonium bases. By Rasik Lal Datta.....	79	426
<i>April 3rd.</i>		
77. Studies in the camphane series. Part XXXIV. Configuration of the eight oximino-derivatives of camphorquinone. By Martin Onslow Forster.....	104	662
78. The action of ozone on cellulose. Part III. Action on beech wood (lignocellulose). By Charles Dorée and Mary Cunningham.....	104	677
79. The formation of cyclic compounds from derivatives of 2:2'-ditolyl. By James Kenner.....	105	613
80. The new oxide of carbon, mellitic anhydride, and derivatives of mellitic acid. (Preliminary note.) By William John Jarrard.....	106	—
81. Synthesis of a methyl tetrose. (Preliminary note.) By Robert Gilmour	108	—
82. Experiments on the Walden inversion. Part IX. Interconversion of the optically active phenylmethylcarbinols. By Alex. McKenzie and George William Clough	109	687
83. Externally compensated hydroxyhydrazinohydrindene, its derivatives and resolution into optically active components. By David Henry Peacock	109	669
84. Studies in substituted quaternary azonium compounds containing an asymmetric nitrogen atom. Part I. Resolution of phenylmethylethylazonium iodide into optically active components. By Bawa Kartar Singh	109	604
85. The constitution of allantoin. By Arthur Walsh Titherley.....	109	1336
86. Gossypetin. By Arthur George Perkin.....	110	650
87. The alleged permeability of glass to halogen vapours. By James Brierley Firth	111	—
88. Preparation of amine nitrites. By Pañchañan Neogi ...	112	—
89. A criticism of some recent viscosity investigations. By Eugene C. Bingham.....	113	959
90. Cyanogen and cyanogen bromide. By Augustus Edward Dixon and John Taylor.....	113	974

	Page in Pro- ceedings.	Page in Trans- actions.
91. The spectroscopic investigation of the carbinol-ammonium base isomerism. Part II. Derivatives of cinnamylidene- <i>p</i> -toluidine. By Charles Kenneth Tinkler.....	114	885
92. The influence of colloids and fine suspensions on the solubility of gases in water. Part III. Solubility of carbon dioxide at pressures lower than atmospheric. By Alexander Findlay and Thomas Williams	115	636
93. Quinonoid addition as the mechanism of dyestuff formation. By Arthur George Green	116	925
94. Sodium iodide with acetone of crystallisation. By Kathleen Shipsey and Emil Alphonse Werner	117	—
95. Denitrification the result of enzyme action. (Preliminary note.) By William Hulme.....	117	—
96. Allylamine derivatives: the identification of proline. By Wilhelm Glund	118	940
97. Solubilities of salts of ammonium bases in water and in chloroform. Part I. Solubility as a constitutive property. But Cyril James Peddle and William Ernest Stephen Turner	119	1202
<i>April 17th.</i>		
98. The action of tartaric acid on tin in the presence of oxygen. By Alfred Chaston Chapman	122	775
99. The reaction between ferric salts and thiocyanates. By James Charles Philip and Arthur Bramley.....	123	795
100. The preparation of pure bromine. By Alexander Scott	124	847
101. The preparation of conductivity water. By Robert Bourdillon	124	791
102. The constitution of the anhydro-bases derived from tetrahydroberberine alkyl hydroxides. By Frank Leo Pyman	125	817
103. The application of Hoffmann's reaction to dialkylacetamides. By Frank Lee Pyman	126	852
104. Derivatives of <i>o</i> -xylene. By John Lionel Simonsen ...	126	1144
105. Synthetical production of derivatives of dinaphthanthracene. By William Hobson Mills and Mildred Mills.....	126	—
106. The alcohols of the hydroaromatic and terpene series. (Preliminary note.) By Robert Howson Pickard, William Lewcock, and Joseph Yates	127	—
107. A new variety of manna and a note on the melting point of dulcitol. By John Ralph Furlong and Lawrence Eversley Campbell	128	—
108. Blue adsorption compounds of iodine. Part II. The influence of constitution on the adsorption by 2- and 4-pyrone derivatives. By George Barger and Walter William Starling	128	—
109. Reactions of halogen-substituted acids. Part I. The action of sodium hydroxide and methoxide in methyl-alcoholic solution on bromoacetic, α -bromopropionic, and monobromosuccinic acids. By Erik Høst Madsen.	129	965

	Page in Pro- ceedings.	Page in Trans- actions.
110. The preparation and analysis of methane. By Colin Campbell and Albert Parker	130	1292
111. Influence of increase of initial temperature on the explosiveness of gaseous mixtures. By Albert Parker	130	934
112. Keto-enolic tautomerism and the absorption spectra of the aliphatic ketones. By Harry Medforth Dawson.	130	1308
113. Experiments on the synthesis of apomorphine. By Francis William Kay and Amé Pictet	131	947
114. The absorption spectra of various derivatives of benzene. By John Edward Purvis and Nial Patrick McClelland.	132	1088
115. Notes on the determination of the electrical conductivity of solutions. By Harold Hartley and William Henry Barrett.	132	786
116. Mechanism of the transformation of ammonium cyanate into carbamide, and of the decomposition of carbamide by heat. The polymerisation of cyanic acid. By Emil Alphonse Werner.....	132	1010
117. Non-aromatic diazonium salts. Part I. Antipyrine-diazonium salts and their azo-derivatives. By Gilbert T. Morgan and Joseph Reilly	133	808
118. The fractionation of alloys and minerals in the electric micro-furnace. By Arnold Lockhart Fletcher.....	134	2097

May 1st.

119. Bismuthinitrites. By Walter Craven Ball and Harold Helling Abram	150	2110
120. Constitution of aliphatic diazo-compounds. By Martin Onslow Forster and David Cardwell	150	861
121. The influence of temperature and pressure on the rate of volatilisation of zinc and of cadmium. By Theketh Kumaran Nair and Thomas Turner	151	1534
122. Dinaphthathioxin and isodinaphthathioxin. By Thomas Joseph Nolan and Samuel Smiles	151	901
123. Constitution of furoxans (dioxime "peroxides"). By Martin Onslow Forster and Matthew Felix Barker....	152	1918
124. Constitution of oxadiazole oxides (furan oxides or dioxime peroxides). By Arthur George Green and Frederick Maurice Rowe	152	897
125. The estimation of zinc as zinc ammonium phosphate and zinc pyrophosphate. By Thomas Matthew Finlay and Alexander Charles Cumming	153	1004
126. Condensation of acetonedicarboxylic acid with phenols. By Biman Bihari Dey	154	—
127. Oxidation of sphingosin. By Arthur Lapworth.....	154	1029
128. The conversion of sodium hydrosulphide into sodium monosulphide. By John Smeath Thomas and Alexander Rule	154	871
129. Condensation of camphorquinone with phenols. By Hemendra Kumar Sen-Gupta and Biman Bihari Dey.	155	—

	Page in Pro- ceedings.	Page in Trans- actions.
130. The interconversion of α -hydroxy-acids and α -ketonic aldehydes: a reversible reaction. By Henry Drysdale Dakin and Harold Ward Dudley	156	—
131. The bacterial oxidation of phenol. By Gilbert John Fowler and Ernest Moore Mumford	156	—
132. The vapour pressures of binary mixtures. Part II. The partial pressure of glyceryl trinitrate in solution in acetone. By Arthur Marshall	157	—
133. Carbamido- and other derivatives of $\alpha\beta$ -dipropylamino- and $\alpha\beta$ -diallylamino-propionic acids. By Edward Percy Frankland and Henry Edgar Smith	158	998
134. The relative activities of certain organic iodo-compounds with sodium phenoxide in alcoholic solution. Part I. Some normal primary alkyl iodides. By David Segaller.....	159	1154
135. An attempt to resolve an oxonium salt. By Stanley Issac Levy, Eric John Holmyard, and Siegfried Ruhemann	159	—
136. The spontaneous crystallisation of solutions of potassium chloride, bromide, and iodide. By Bernard Mouat Jones and Popatlal Govindlal Shah...	160	1043
137. The absorption spectra of some derivatives of the nitroaminophenols in relation to their constitution. By Raphael Meldola and John Theodore Hewitt.....	160	876
138. Colours produced by tetranitronitethane with compounds containing elements capable of showing change in valency. By Hans Thacher Clarke, Alexander Killen Macbeth, and Alfred Walter Stewart.....	161	—
139. Note on the oil of the fruits of <i>Alpinia alba</i> , Rose. By Samuel Shrowder Pickles and John Campbell Earl	164	—

May 15th.

140. Studies of dynamic isomerism. Part XV. The influence of light on isomeric change. By Thomas Martin Lowry and Harold Reuben Courtman	168	1214
141. Derivatives of <i>o</i> -xylene. Part III. The presence of a mobile nitro-group in each of the two trinitro- <i>o</i> -xylenes. By Arthur William Crossley and Walter Ryley Pratt	169	982
142. Derivatives of <i>o</i> -xylene. Part IV. Synthesis of 4:5-dibromo-3- <i>o</i> -xylenol. By Arthur William Crossley and Sidney Smith	170	989
143. The synthetical preparation of the <i>d</i> -glucosides of sitosterol, cholesterol, and some fatty alcohols. By Arthur Henry Salway	170	1022
144. The rotatory dispersive power of organic compounds. Part I. The measurement of rotatory dispersion. By Thomas Martin Lowry	171	1062

	Page in Pro- ceedings.	Page in Trans- actions.
145. The rotatory dispersive power of organic compounds. Part II. The form of the rotatory-dispersion curves. By Thomas Martin Lowry and Thomas William Dickson	171	1067
146. Synthesis of unsymmetrical derivatives of deoxy. benzoïn. By John Cannell Cain, John Lionel Simonsen, and Clarence Smith	172	1035
147. A constant pressure viscometer. By William Hamilton Patterson	172	—
148. The chemical nature of some radioactive disintegration products. Part II. By Alexander Fleck.....	172	1052
149. The estimation of small quantities of lead. By Alfred Vincent Elsdon and John Firth Stansfield	173	1039
150. The iodocinnamic acids. By Thomas Campbell James	173	1368
151. Rate of evolution of gases from supersaturated solutions. Part I. Influence of colloids and of suspensions of charcoal on the evolution of carbon dioxide. By Alexander Findlay and George King	173	1170
152. Viscosity maxima and their interpretation. By Ferdinand Bernard Thole, Albert George Mussell, and Albert Ernest Dunstan.....	174	1108
153. Condensation of aromatic aldehydes with pyruvic acid. By Eva Lubrzenska and Ida Smedley	174	—
154. The isolation and purification of cerebrone. By Arthur Lapworth	175	1029
155. Cyaphenine. By John Edwin Mackenzie	175	—
156. Note on the identification of proline. By Wilhelm Gluud	177	—
<i>June 5th.</i>		
157. The relation between the absorption spectra and constitution of piperidine, nicotine, cocaine, atropine, hyoscyamine, and hyoscyne. By James Johnston Dobbie and John Jacob Fox.....	180	1193
158. The constituents of hops. By Frederick Belding Power, Frank Tutin, and Harold Rogerson.	180	1267
159. The nitrogenous constituents of hops. (Preliminary note.) By Alfred Chaston Chapman.....	182	—
160. Anomalous rotatory dispersion. (Preliminary note.) By Thomas Martin Lowry and Thomas William Dickson	185	—
161. Equivalent conductivities of sodium hyponitrite, calcium hyponitrite, and hyponitrous acid. By Prafulla Chandra Ray, Rajendralal De, and Nilratan Dhar.....	185	1562
162. Double carbonates of the alkaline earth metals and lead with potassium carbonate. By Rasik Lal Datta and Haridas Mukherjea	185	—

	Page in Pro- ceedings.	Page in Trans- actions.
163. The estimation of nitrites by means of thiocarbamide, and the interaction of nitrous acid and thiocarbamide in presence of acids of different strength. By May Emily Coade and Emil Alphonse Werner	188	1221
164. A case of isomerism in the methyiated ferrocyanides. By Ernald George Justinian Hartley	188	1196
165. Preparation of secondary amines from carboxylic acid. Part III. Dissecondary amines from dicarboxylic acids. By Henry Rondel Le Sueur	189	1119
166. Guanidine thiocyanate: its formation from ammonium thiocyanate. By Hans Krall.....	189	1378
167. Silicon compounds. Part I. Rational nomenclature of complex silicon compounds and silicates, both organic and inorganic. By Geoffrey Martin.....	190	—
168. Silicon compounds. Part II. Methylsilicoses derived from silicon hexachloride. By Geoffrey Martin	190	—
169. The synthesis of <i>o</i> -aldehydophenylglycine. By Wilhelm Glud.....	190	1251
170. Colour and constitution of azomethine compounds. Part III. By Frank George Pope and Winifred Isabel Willett	191	1258
171. Note on cupric malate and citrate. By Spencer Umfreville Pickering.....	191	1354
172. Organic ferric salts. By Spencer Umfreville Pickering.	191	1358
173. The colour intensity of iron. By Spencer Umfreville Pickering	192	—
174. The conversion of α -amino-acids into α -ketonic aldehydes, and their relation to α -hydroxy-acids. By Henry Drysdale Dakin and Harold Ward Dudley ...	192	—
175. The mode of combustion of carbon: the effect of drying the oxygen. By Thomas Fred Eric Rhead and Richard Vernon Wheeler	193	1210
176. Cantharene, and other hydrocarbons allied to the terpenes. By Walter Norman Haworth	193	1242
177. The molecular condition of mixed liquids. Part I. Mixtures of the lower aliphatic alcohols with water. By William Ringrose Gelston Atkins and Thomas Arthur Wallace	194	1461
178. The purification of acetone by means of sodium iodide. By Kathleen Shipsey and Emil Alphonse Werner ...	194	1255
179. The absorption spectra of some thio-derivatives of benzene. By John Jacob Fox and Frank George Pope	194	1263
180. The nickel salts of the benzildioximes. By Frederick William Attack	195	1317
181. Preparation of secondary and tertiary acid amides from their metallic derivatives. By Jitendra Nath Rakshit.....	195	1557
182. The addition of negative radicles to Schill's bases. By Thomas Campbell James and Clifford William Judd	196	—
183. The preparation of some organo-selenium compounds. (Preliminary note.) By Charles Weizmann and Henry Stephen	196	—

	Page in Pro- ceedings.	Page in Trans- actions.
184. β -Naphthol sulphide and <i>iso</i> - β -naphthol sulphide; and the constitution of β -naphthol. By Thomas Joseph Nolan and Samuel Smiles.....	197	—
185. The nitrites of thallium, lithium, caesium, and rubidium. By Walter Craven Ball and Harold Helling Abrain	197	2130
186. Note on the fat of the seeds of <i>Oncoba echinata</i> ; occurrence of the chaulmoogric acid. By Ernest Goulding and Noel Charles Akers	197	—
187. A new model to illustrate the Walden inversion. By William Edward Garner	198	—
188. The Baly-Krulla theory of fluorescence. A reply to A. K. Macbeth. By Edward Charles Cyril Baly.....	201	—
<i>June 19th.</i>		
189. Absorption spectra and chemical reactivity. Part III. Trinitrobenzene, trinitroanisole, and pieric acid. By Edward Charles Cyril Baly and Francis Owen Rice...	216	2035
190. Derivatives of <i>o</i> -xylene. Part V. 5-Bromo- <i>o</i> -4-xyleneol and 6-bromo- <i>o</i> -4-xyleneol. By Arthur William Crossley and Dorothy Jessie Bartlett	217	1297
191. The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures. Part II. By John Norman Collie and Hubert Sutton Patterson	217	—
192. The rotatory dispersive power of organic compounds. Part III. The measurement of magnetic rotatory dispersion. By Thomas Martin Lowry	221	1322
193. The rotatory dispersive power of organic compounds. Part IV. Magnetic rotation and dispersion in some simple organic liquids. By Thomas Martin Lowry...	221	81*
194. The isomerism of <i>p</i> -azophenol. By Philip Wilfred Robertson	221	1472
195. The action of ozone on cellulose. Part IV. Cellulose peroxide. By Charles Dorée	222	1347
196. Sylvestrene. The constitution of <i>d</i> -sylvestrene and its derivatives. By Walter Norman Haworth, William Henry Perkin, jun., and Otto Wallach	223	1228
197. The refractivities of acenaphthene and its monohalogen derivatives. By Holland Crompton and Wilhelmina Rebecca Smyth	224	1302
198. The formation of cyclic bases from aromatic imides. (Preliminary note.) By Edward Hope and Frederick Russell Lankshear	224	—
199. The action of sulphur dioxide on copper at high temperatures. By Clifford Morgan Stubbs	225	1445
200. The change of colour of metallic haloid solutions. By Charles Scott Garrett... ..	225	1433
201. Hydroxyazo-compounds. The action of semicarbazide hydrochloride on the <i>p</i> -quinones. By Isidor Morris Heilbron and James Alexander Russell Henderson ...	226	1404

	Page in Pro- ceedings.	Page in Trans- actions.
202. The alkaloids of ipecacuanha. (Preliminary note.) By Francis Howard Carr and Frank Lee Pyman	226	—
203. Dibenzoyldiaminoacetic acid. By Paul Haas	228	1304
204. The so-called calcium β -diglycerylphosphate: A correction. By Frank Tutin	228	—
205. Some derivatives of desylamine. By Alex. McKenzie and Fred Barrow	228	1331
206. Influence of substitution on the reactivity of <i>p</i> - phenylenediamine. By Gilbert T. Morgan and Joseph Allen Pickard	229	—
207. The constitution of the ortho-diazoimines. Part III. The α - and β -acyl-3:4-tolylenediazoimides as structural isomerides. By Gilbert T. Morgan and Frances Mary Gore Micklethwait	232	1391
208. The occurrence of neon in vacuum-tubes containing hydrogen. By Irvine Masson	233	—
209. A simple and efficient method of dehydrating substances by electrical heating in a vacuum. By William Ernest Stephen Turner and Crellyn Colgrave Bissett	233	—
210. The vapour density of ammonium nitrate, benzoate, and acetate. By Prafulla Chandra Rây and Sarat Chandra Jana	234	1565
211. The action of nitric oxide on a neutral solution of potassium permanganate. By Barun Chandra Dutt, Bamacharan Chatterji, and Haridas Banerji	235	—
<i>Papers received during the vacation and published, or passed for publication, in the Transactions:</i>		
212. The viscosity of cellulose nitrate solutions. By Frank Baker	244	1653
213. Geranyl chloride. By Martin Onslow Forster and David Cardwell	244	1338
214. A new method of preparing <i>m</i> -chlorobenzoic acid and the investigation of its hydroxylamine salt. By Wilhelm Glund and Richard Kempf	244	1530
215. Contributions to our knowledge of semicarbazones. Part III. Action of heat on the semicarbazones of phenyl styryl ketone and the preparation of the corresponding phenylsemicarbazones. By Isidor Morris Heilbron and Forsyth James Wilson	245	1504
216. Contributions to the chemistry of the terpenes. Part XVI. The oxidation of bornylene with hydrogen peroxide. By George Gerald Henderson and William Caw	246	1543
217. The relative activities of certain organic iodo-com- pounds with sodium phenoxide in alcoholic solution. Part II. <i>iso</i> -, <i>sec</i> -, and <i>tert</i> -alkyl iodides. By David Segaller	246	1421

	Page in Pro- ceedings.	Page in Trans- actions.
218. Non-aromatic diazonium salts. Part II. Azo-derivatives from antipyrinediazonium salts and their absorption spectra. By Gilbert T. Morgan and Joseph Reilly.....	247	1494
219. The ten stereoisomeric tetrahydroquinaldinomethylene, camphors. By William Jackson Pope and John Read.....	247	1515
220. The isomerism of the oximes. Part I. The diphenyl-carbamylloximes. By Oscar Lisle Brady and Frederick Percy Dunn.....	248	1613
221. The isomerism of the oximes. Part II. The nitro-benzaldoximes. By Oscar Lisle Brady and Frederick Percy Dunn.....	248	1619
222. The azo-derivatives of 2:2'-diphenol. By Philip Wilfred Robertson and Oscar Lisle Brady.....	248	1479
223. The constitution of the trinitro- <i>p</i> -aminophenols and trinitro- <i>p</i> -anisidines. By Raphael Meldola and Frédéric Reverdin	248	1484
224. A new method for the determination of the concentration of hydroxyl ions. By Francis Francis and Frank Henry Geake	249	1722
225. The relation between residual affinity and chemical constitution. Part IV. Some open-chain compounds. By Hans Thacher Clarke	249	1689
226. The reduction of mercuric chloride by sodium formate. By Alexander Findlay and Morton James Pryce Davies	250	1550
227. The volatile constituents of coal. Part III. By Arthur Herbert Clark and Richard Vernon Wheeler.	250	1704
228. The volatile constituents of coal. Part IV. The relative inflammabilities of coal dusts. By Richard Vernon Wheeler.....	250	1715
229. The methylation of cellulose. By William Smith Denham and Hilda Woodhouse.....	251	1735
230. The structure of the salts of nitrophenols. By John Theodore Hewitt, Rhoda Marianne Johnson, and Frank George Pope	251	1626
231. The neutral and acid oxalates of potassium. By Harold Hartley, Julien Drugman, Charles Archibald Vlieland, and Robert Bourdillon.....	252	1747
232. Adiabatic and isothermal compressibilities of some liquids between one and two atmospheres' pressure. By Daniel Tyrer.....	252	1675
233. The constitution of aconitine. By Oscar Lisle Brady	253	1821
234. The methylation of quercetin. By Arthur George Perkin	253	1632
235. The absorption spectra of various derivatives of aniline, phenol, and benzaldehyde. By John Edward Purvis	253	1638
236. The chemistry of the glutaconic acids. Part VIII. β -Phenylglutaconic acid and the β -phenyl- α -methylglutaconic acids. By Jocelyn Field Thorpe and Arthur Samuel Wood	253	1569

	Page in Pro- ceedings.	Page in Trans- actions.
237. The chemistry of the glutaconic acids. Part IX. A method for distinguishing between the esters of the normal and labile acids. By Jocelyn Field Thorpe and Arthur Samuel Wood.....	254	1579
238. The chemistry of the glutaconic acids. Part X. The alkylations of the ethereal salts. By Jocelyn Field Thorpe and Arthur Samuel Wood	255	1752
239. The formation and reactions of imino-compounds. Part XVIII. The condensation of <i>cyclohexanones</i> with cyanoacetamide involving the displacement of an alkyl group. By Jocelyn Field Thorpe and Arthur Samuel Wood.....	256	1586
240. The replacement of alkyl groups in tertiary aromatic bases. By Jocelyn Field Thorpe and Arthur Samuel Wood	257	1601
241. Coumaranone derivatives. Part II. The constitution of ethyl coumaranonecarboxylate. By Richard William Merriman	257	1838
242. Coumaranone derivatives. Part III. Acylazo-derivatives of coumaranonecarboxylic acid. By Richard William Merriman	258	1845
243. The dynamics of bleaching. By Sydney Herbert Higgins	258	1816
244. Note on the structure of certain lactones formed by the fission of the <i>gem</i> .-dimethylcyclopropane ring. By William Henry Perkin, jun., and Jocelyn Field Thorpe	259	1760
245. The resolution of 2:3-diphenyl-2:3-dihydro-1:3:4-naphthaisotriazine into optically active components. By William Jackson Pope and Clara Millicent Taylor	259	1763
246. The mutual solubilities of ethyl acetate and water and the densities of mixtures of ethyl acetate and ethyl alcohol. By Richard William Merriman	259	1774
247. The azeotropic mixtures of ethyl acetate, ethyl alcohol, and water at pressures above and below the atmospheric pressure. Part I. By Richard William Merriman	259	1790
248. The azeotropic mixtures of ethyl acetate, ethyl alcohol, and water at pressures above and below the atmospheric pressure. Part II. By Richard William Merriman.....	260	1801
249. The mechanism of the condensation of glucose with acetone. By James Leslie Auld Macdonald	260	1896
250. Condensation of acid chlorides with the ethyl esters of (a) cyanoacetic acid, (b) malonic acid, and (c) acetoacetic acid. Part I. By Charles Weizmann, Henry Stephen, and Ganesh Sakharani Agashio	261	1855
251. 2-Phenyl-5-styryloxazole. By Robinson Percy Foulds and Robert Robinson	261	1768
252. The action of sulphur chloride and of thionyl chloride on metallic salts of organic acids: preparation of anhydrides. By William Smith Denham and Hilda Woodhouse	261	1861
253. The action of magnesium aryl haloids on glyoxal. By Henry Wren and Charles James Still	262	1770

	Page in Pro- ceedings.	Page in Trans- actions.
254. The miscibility of solids. Part II. The influence of chemical constitution on the thermal properties of binary mixtures. By Ernest Vanstone	262	1826
255. The solubilities of alkali haloids in methyl, ethyl, propyl, and <i>iso</i> amyl alcohols. By William Ernest Stephen Turner and Crellyn Colgrave Bissett	263	1904
256. Nitration of 1-chloro-2:4-dinitronaphthalene. By Max Rindl	263	1911
257. The decomposition of carbamide. By George Joseph Burrows and Charles Edward Fawsitt.....	264	—
258. The viscosity of sugar solutions. By Charles Wilfrid Roberts Powell	264	1*
259. The rate of hydration of acid anhydrides: acetic, propionic, butyric, and benzoic. By Bernard Howell Wilsdon and Nevil Vincent Sidgwick	265	1959
260. Investigations on the dependence of rotatory power on chemical constitution. Part IV. The rotatory powers of the secondary alcohols of the formula $C_2H_5\cdot CH(OH)\cdot R$. By Robert Howson Pickard and Joseph Kenyon	266	1923

Papers received during the vacation :

261. The mechanism of the benzoin synthesis. (Preliminary note.) By Gertrude Maud Robinson and Robert Robinson	266	—
262. Some derivatives of phenanthraquinone. (Preliminary note.) By Kshitish Chandra Mukerjee and Edwin Roy Watson	268	—
263. Some derivatives of 2:3:4:2'-tetrahydroxybenzophenone. (Preliminary note.) By Narendra Nath Sen Gupta and Edwin Roy Watson.....	269	—
264. The constitution of phenolphthalein and its alkali salts. By Morris Fort and Frank Leslie Barrett.....	270	—
265. Complex metal ammonias. <i>cis</i> -Sulphonyldiacetato-diethylenediaminecobaltic hydrogen sulphonyldiacetate. (Preliminary note.) By Thomas Slater Price and Sidney Albert Brazier	272	—

November 6th.

266. The conversion of orthonitroamines into <i>isoox</i> adiazole oxides (furoxans). By Arthur George Green and Frederick Maurice Rowe.....	275	2023
267. The constitution of aniline-black. Part IV. By Arthur George Green and William Johnson	276	—
268. The constituents of senna leaves. By Frank Tutin ...	278	2006
269. A series of mixtures of nitro-compounds and amines, which are coloured in the liquid state only. By Charles Kenneth Tinkler	278	2171

	Page in Pro- ceedings.	Page in Trans- actions.
270. A study of some organic derivatives of tin as regard their relation to the corresponding silicon compounds. Part II. Condensation products of dihydroxydibenzylstannane. By Thomas Alfred Smith and Frederic Stanley Kipping	280	2034
271. 6'-Aminoquercetin. By Edwin Roy Watson	280	—
272. Measurement of the rate of reaction by the change of volume in solution. By Robert Wright	280	—
273. Amalgams containing silver and tin. By William Arthur Knight and Reginald Arthur Joyner.....	282	2247
274. The action of chlorine on <i>m</i> -iodoaniline and on <i>m</i> -bromoaniline. By Hamilton McCombie and Percy James Ward	283	1995
275. Guanidinim nitrite and its decomposition by heat. By Prafulla Chandra Rây, Manik Lal Dey, and Sarat Chandra Jâna	283	—
276. The absorption of light by uranous chloride in different solvents. By Thomas Ralph Merton.....	284	23*
277. The influence of solvents on the rotation of optically-active compounds. Part XIX. The rotation of certain derivatives of lactic acid. By Thomas Stewart Patterson and William Collins Forsyth ...	284	2263
278. The action of nitrogen iodide on methyl ketones. By Frederiek Daniel Chattaway and Robert Reginald Baxter	284	1986
279. Note on the constituents of commercial chrysarobin. By Frank Tutin and Hubert William Bentley Clewer	285	—
280. Substituted dihydroresorcin. 1-Methyldihydroresorcin and 2-methyldihydroresorcin. By Charles Gilling	286	2029
281. Researches on the constitution of physostigmine. Part III. The formation of substituted indoles from <i>m</i> -4-xylydine, and the reduction of 3-nitro- <i>p</i> -tolyl-acrylic acid. By Arthur Henry Salway	287	1988
282. Mechanism of the decomposition of carbamide and biuret by heat, and of the formation of ammelide. By Emil Alphonse Werner	287	2275
283. Note on the mechanism of α -bromination in ketones. By Arthur Lapworth	289	—
284. Studies in the diphenyl series. Part V. Derivatives and substitution products of the two isomeric <i>o</i> -dinitrobenzidines and synthesis of derivatives of benzerythrene. By John Cannell Cain, Albert Coulthard, and Frances Mary Gore Micklethwait.....	289	2074
285. Harmine and harmaline. Part II. The synthesis of <i>isoharman</i> . By William Henry Perkin, jun., and Robert Robinson.....	290	1973
<i>November 20th.</i>		
286. Investigations on the dependence of rotatory power on chemical constitution. Part V. The simpler esters of the carbinols, $\text{CH}_3\cdot\text{CH}(\text{OH})\cdot\text{R}$. By Robert Howson Pickard and Joseph Kenyon	296	—

	Page in Pro- ceedings.	Page in Trans- actions.
287. Co-ordination of rotatory powers for different wave-length, temperatures and solutions. (Preliminary note.) By Robert Howson Pickard and Joseph Kenyon	296	—
288. The interaction of sodium amalgam and water. By Herbert Brereton Baker and Leslie Henry Parker ...	298	2060
289. The action of variously treated waters on sodium amalgam. By Leslie Henry Parker	299	2071
290. The polymerisation of cyanamide. By George Francis Morrell and Peter Burgen.....	300	—
291. Some derivatives of oleanol. By Frank Tutin and William Johnson Smith Naunton	301	2050
292. Some derivatives of phorone. Part I. By Francis Francis and Francis George Willson	302	2238
293. The porosity of iron. By William Hughes Perkins...	302	102*
294. The bleaching action of hypochlorite solutions. By Sidney Herbert Higgins	302	—
295. Guaiacum resin as a reagent for the detection of oxydases and of minute traces of copper. By William Ringrose Gelston Atkins	303	—
296. The absorption spectra of various derivatives of pyridine, piperidine and piperazine in solution and as vapours. By John Edward Purvis	303	2283
297. Derivatives of <i>p</i> -iodoaniline. By Frederick Daniel Chattaway and Alfred Bertie Constable.....	304	124*
298. The interaction of tetranitromethane and compounds containing centres of residual affinity. (Preliminary note.) By Ernest Magowan Harper and Alexander Killen Macbeth	304	—
299. The relative activities of certain organic iodo-compounds with sodium phenoxide in alcoholic solution. Part III. The temperature-coefficients. By David Segaller.....	305	106*
300. Resolution of α -anilinostearic acid. By Henry Rondel Le Sueur	306	2108
301. The conversion of <i>d</i> -glucosamine into <i>d</i> -mannose. (Preliminary note.) By James Colquhoun Irvine and Alexander Hynd.....	306	—
302. The mechanism of denitrification. By William Hulme	307	—
303. The catalytic activity of acids. Evaluation of the activities of the hydrogen ion and the undissociated acid. By Harry Medforth Dawson and Frank Powis	308	2135
304. The configuration of the doubly-linked nitrogen atom. Optically active salts of the semicarbazone and benzoylphenylhydrazone of cyclohexanone-4-carboxylic acid. By William Hobson Mills and Alice Mary Bain	309	64*
<i>December 4th.</i>		
305. The action of sulphuric acid on copper. By (the late) James Tudor Cundall.....	344	60*
306. Synthesis of polypeptides from the higher fatty acids. By Arthur Hopwood	345	—

	Page in Pro- ceedings.	Page in Trans- actions
307. A new series of ring compounds. (Preliminary note.) By Richard Moore Beesley and Jocelyn Field Thorpe.....	346	—
308. Organic derivatives of silicon. Part XX. Some condensation products of dibenzylsilicanediol. By Robert Robison and Frederi Stanley Kipping.....	343	40*
309. The rotatory dispersive power of organic compounds. Part V. A comparison of the optical and magnetic rotatory dispersions in some optically active liquids. By Thomas Martin Lowry, Robert Howson Pickard, and Joseph Kenyon	348	94*
310. A relation between chemical constitution and depth of colour of dyes. By Edwin Roy Watson	348	—
311. Dyes derived from quercetin. By Edwin Roy Watson and Kumnd Behari Sen.....	349	—
312. An improved apparatus for the determination of molecular weight by the Landsberger-Sakurai method. By William Ernest Stephen Turner and Cornelius Theodore Pollard	349	—
313. The optical rotatory power of derivatives of succinic acid in aqueous solutions of inorganic salts. Part I. By George William Clough	352	49*
314. Derivatives of <i>o</i> -xylene. Part VI. 5-Bromo- <i>o</i> -3-xyleneol. By Arthur William Crossley	352	2179
315. The condensation of chloral hydrate and carbamide. By Noel Guilbert Stevenson Coppin and Arthur Walsh Titherley.....	352	82*
316. The action of amino-acid esters on ethyl dicarboxy- glutamate. By Stanley Isaac Levy.....	353	27*
317. The relationship between the absorption spectra and the constitution of ketones and their derivatives. Part I. By George Gerald Henderson, James Alexander Russell Henderson, and Isidor Morris Heilbron	354	—
318. Note on purpurogallin. By Arthur George Perkin ...	354	—
319. <i>l</i> -Epicamphor (<i>l</i> - β camphor). By Julius Bredt and William Henry Perkin, jun.	356	2182
320. The action of hydrogen peroxide on the sodium alkyl thiosulphates. By Douglas Frank Twiss	356	36*
321. Synthesis of <i>d</i> - and <i>l</i> -sylvestrene. By Walter Norman Haworth and William Henry Perkin, jun.....	356	2225
322. Note on the configurations of the optically active normal secondary alcohols. By George William Clough	357	—
323. The surface tension of mixtures. Part I. Mixtures of partly miscible liquids and the influence of solubility. By Ralph Palliser Worley	359	260*
324. The surface tension of mixtures. Part II. Mixtures of perfectly miscible liquids and the relation between their surface tensions and vapour pressures. By Ralph Palliser Worley	360	273*
325. The tautomerism of thioanilides. By Percy May	360	2272
326. The determination of viscosity. By Malcolm Percival Applebey	361	2167

	Page in Pro- ceedings.	Page in Trans- actions.
327. Lead cyanide. By Nalini Mohan Gupta	361	—
328. Contributions to the theory of solutions. The intermiscibility of liquids. By John Holmes	362	2147
329. A contribution to the study of the constitution of the methyl pentoses. Part I. The synthesis of an <i>i</i> -methyl tetrose and an <i>i</i> -methyl tetritol. By Robert Gilmour	363	73*
<i>December 18th.</i>		
330. Absorption of gases by celluloid. By Victor Lefebure	368	—
331. Aromatic compounds obtained from the hydroaromatic series. Part III. Bromoxylanols from dimethyldi- hydroresorcin. By Arthur William Crossley and Nora Renouf	369	165*
332. The equilibrium of dilute hydrochloric acid and gelatin. By Henry Richardson Procter	370	—
333. Researches on residual affinity and co-ordination. Part I. Metallic acetylacetones and their absorption spectra. By Gilbert T. Morgan and Henry Webster Moss	371	189*
334. Ionisation and the law of mass action. Part II. The osmotic data in relation to combined water. By William Robert Bousfield	371	—
335. Chemical examination of sarsaparilla root By Frederick Belding Power and Arthur Henry Salway.....	372	201*
336. Metallic derivatives of acetylacetone and acetyl mesityl oxide. (Preliminary note.) By Gilbert Thomas Morgan and Henry Webster Moss	373	—
337. Constitution of the ortho-diazoimines. Part IV. Isomeric benzenesulphonyl-3:4-tolylenediazoimides. By Gilbert Thomas Morgan and Godfrey Edward Scharff	374	117*
338. Organic derivatives of silicon. Part XXI. The con- densation products of diphenylsilicanediol. By Frederic Stanley Kipping and Robert Robison	374	—
339. The absorption spectra of sulphurous acid and sulphites. (Preliminary note.) By Robert Wright	375	—
340. An adiabatic colorimeter. By Francis William Gray.	376	—
341. The distillation of coal in a vacuum. By Maurice John Burgess and Richard Vernon Wheeler	376	131*
342. The composition of coal. By David Trevor Jones and Richard Vernon Wheeler	376	140*
343. <i>iso</i> Melamine. (Preliminary note.) By Hans Krall ...	377	—
344. Fluorone derivatives. Part II. Resorcinol-benzoin. By Frank George Pope	378	251*
345. The relation between viscosity and chemical constitu- tion. Part VIII. Some homologous series. By Albert Ernest Dunstan, Ferdinand Bernard Thole, and Percy Benson.....	378	—
346. Non-aromatic diazonium salts. Part III. 3:5-Di- methylpyrazole-4-diazonium salts and their azo- derivatives. By Gilbert T. Morgan and Joseph Reilly	379	—

	Page in Pro- ceedings.	Page in Trans- actions.
347. The relative activities of certain organic iodo-compounds with sodium phenoxide. Part IV. The influence of the solvent. By David Segaller	379	112*
348. The polysulphides of the alkali metals. Part I. The polysulphides of sodium. By Alexander Rule and John Smeath Thomas	380	177*
349. Nitro-acids derived from 2:3-dimethoxybenzoic acid and 4-methoxyphthalic acid. By John Cannell Cain and John Lionel Simonsen	380	156*
350. The <i>p</i> -nitrobenzoates of borneol and <i>isoborneol</i> . By George Gerald Henderson and Isidor Morris Heilbron	381	—
351. The identity of the supposed β -2:5-dimethylpiperazine. By William Jackson Pope and John Read ...	382	219*
352. Oxidation of the anhydrides of 1:1-dihydroxydinaphthylalkylmethanes. (Preliminary note.) By Hemendra Kumar Sen-Gupta	382	—
353. The relation of uranous salts to thorium. By Alexander Fleck.....	383	247*
354. The system: xylene-alcohol-water. By Alfred Holt and Norman Murray Bell	383	—
355. Interaction of glycerol and oxalic acid.† By Frederick Daniel Chattaway	383	151*
EXTRA MEETINGS.		
March 14th.—Annual General Meeting ..	81	700
May 22nd.—Van't Hoff Memorial Lecture	179	1127
October 23rd.—Ladenburg Memorial Lecture	273	1871

* Papers printed in the Transactions for 1914 are distinguished by an asterisk after the Page number. Where no reference is given to the Transactions, the paper has so far appeared only in the Proceedings.

† This paper was read at the meeting on December 4th, 1913.

LIBRARY RULES.

1. The Library is open for reference, and for the issue and return of books, daily from 10 a.m. to 6 p.m. (Saturdays 10 a.m. to 2 p.m.); and in the evenings of those days on which the Chemical Society meets.

2. Fellows are not allowed to have on loan more than six volumes at a time, without special permission from the Librarian.

3. All Journals, Dictionaries, and Pamphlets of which there are not duplicate copies, and certain early Chemical and other Books distinguished in the Library Catalogue by a star, belong to the Reference Library, and are not for general circulation. Fellows desiring to borrow books from the Reference Library must make a special application in writing to the Librarian, undertaking to bear all risks of transit, &c., and to return the volumes within one month; the Librarian may then, at his discretion, issue such books. This regulation does not apply, however, to volumes of Periodicals of which no duplicate copies exist in the Library.

4. A book may not be taken out of the Library until one month after it has been received.

5. Books must not be removed from the Library until a voucher for them has been signed and delivered to the Librarian.

6. Books are issued either to the Fellow desiring the loan, or to a person bringing a written order from him. In either case a receipt must be given on the form provided. When a Fellow desires a book or books to be sent to him, he must send to the Librarian a written order, and pay the whole cost of carriage. All books borrowed by Fellows shall be at the risk of the borrower from the moment they are issued or despatched by the Librarian, and until they are returned to him.

7. Books may not be sent out of the United Kingdom.

8. Books which have been bespoken shall circulate in the order of application.

9. Fellows shall be at liberty to retain a book one calendar month, unless, at the expiration of a fortnight, notice is received that the book is required by another Fellow, in which case it must be returned at once. Single parts of journals may not be retained longer than one week.

10. The names of Fellows borrowing books shall be entered by the Librarian, or Officer in attendance, in a book kept for that purpose. When a Fellow returns a book, his voucher shall be given to him, and a record of the return duly made.

11. In the case of Fellows returning books by messenger or public conveyance, the voucher shall be returned by the Librarian through the post.

12. Fellows retaining books longer than the time specified, or neglecting to return them when demanded, shall forfeit the right to borrow books from the Library until the volume or volumes be returned.

13. Fellows to whom books have been issued shall be held responsible for their preservation from injury; and if any book when returned is found to have been damaged, the Council may order that it be repaired or replaced at the expense of the borrower. In the event of any book being lost, or being detained after application has been made for its return, the Council may replace, at the cost of the borrower, the volume or volumes so lost or detained. This rule shall also apply to single parts of current periodicals.

14. For the purpose of revision and cleaning, the Library shall be closed for a fortnight in August of each year; before which time all books must be returned, unless special permission has been previously obtained from the Librarian. In the event of any book not being returned on such occasion, the Council may replace it at the cost of the borrower.

15. No persons other than Fellows of the Society have the privilege of using the Library, except upon a written introduction from a Fellow, with whom rests the responsibility for all books consulted by the person introduced. Such introduction shall be valid for one occasion only.

ADDITIONS TO THE LIBRARY DURING THE YEAR 1913.

Abegg, Richard, and **Auerbach, Friedrich** [Editors]. *Handbuch der anorganischen Chemie*. Vol. I. Part ii. Leipzig 1913. pp. x + 904. (*Reference.*)

Accum, Fredrick. *Culinary chemistry*, exhibiting the scientific principles of cookery, with concise instructions for preparing good and wholesome . . . alimentary substances employed in Domestic Economy, with observations on the chemical condition and nutritive qualities of different kinds of food. London 1821. ill. pp. xxiii + 356. (*Reference.*)

Agricola, Georgius. *De Re Metallica*. Translated from the first Latin edition of 1556 with biographical introduction, annotations and appendices upon the development of mining methods, metallurgical processes, geology, mineralogy & mining law from the earliest times to the 16th century. By **Herbert Clark Hoover** and **Low Henry Hoover**. London 1912. pp. [iv] + xxxi + 640. ill. (*Reference.*)

Alchemical Society. *The Journal of the Alchemical Society*. Vol. I, etc. Edited by **Herbert Stanley Redgrove**. London 1913+. (*Reference.*)

Allen, Alfred Henry. *Commercial organic analysis*. Vol. VII. 4th edition. Edited by **William Alfred Davis** and **Samuel S. Sadtler**. London 1913. pp. ix + 563. ill. (*Reference.*)

Amadori, M. See **Bruni, G.**

American Chemical Society. *The Journal of Industrial and Engineering Chemistry*. Vol. V, etc. Easton, Pa. 1913+.

Anderson, C., and **Mingaye, J. C. H.** *Description and analysis of the Binda meteorite*. (From the *Records of the Australian Museum*, 1913, 10.)

Annals of Philosophy; or, magazine of chemistry, mineralogy, mechanics, natural history, agriculture, and the arts. By **Thomas Thomson**. 16 vols. London 1813-1820. [Vols. 1 and 2, *second edition.*]

— New series. [Edited by **Richard Phillips**. 12 vols. London 1821-1826. (*Reference.*)

Anschütz, Richard. See **Loschmidt, Joseph.**

Anschütz, *Richard*. See Richter, *Victor von*.

Arup, *Paul Seidelin*. Industrial organic analysis. London 1913. pp. xii + 340. ill.

Asch, *W.*, and Asch, *D.* The silicates in chemistry and commerce. Including the exposition of a hexite and pentite theory and of a stereo-chemical theory of general application. Translated with critical notes and some additions by *Alfred B. Searle*. London 1913. pp. xx + 456.

Auerbach, *Friedrich*, and Pick, *Hans*. Die Alkalität von Pankreassaft und Darmsaft lebender Hunde. (From the *Arch. Kais. Gesund.*, 1912, 43.)

Auerbach, *Friedrich*. See Abegg, *Richard*.

Barner, *Jacob*. Chymia Philosophica perfecte delineata. Noribergæ 1689. pp. [xiv] + 560 + [lvi]. (*Reference*.)

Barnett, *Edward de Barry*. The preparation of organic compounds. London 1912. pp. xvi + 310. ill.

[Beale, *Sir William Phipson*.] "On the utilization of sewage by phosphate of alumina," "Some further observations on the analysis of water," and "Primeval chemistry." ["B" Club Rhymes, 1867, etc.] (*Reference*.)

Beam, *William*. The determination of humus, especially in heavy clay soils. (From *The Cairo Sci. J.*, 1912, 6.)

Beringer, *Cornelius*, and Beringer, *John J.* A text-book of assaying, for the use of those connected with mines. 13th edition. London 1913. pp. xvi + 459. ill.

Beringer, *John J.* See Beringer, *Cornelius*.

Berry, *Arthur John*. The atmosphere. Cambridge 1913. pp. x + 146. ill.

Beutel, *Ernst*. Bewährte Arbeitsweisen der Metallfärbung. Wien 1913. pp. viii + 88.

Bevan, *Edward John*. See Cross, *Charles Frederick*.

Bluntschli, *F.*, Lasius, *G.*, and Lunge, *Georg*. Die chemischen Laboratorien des Eidgenössischen Polytechnikums in Zürich. Zurich 1889. pp. 39. ill.

Bocci, *Baldvino*. La semplificazione degli enzimi col metodo combinato dell' autolisi e della dialisi. (From the *Proc. verb. R. Accad. Fisiocritici*, Siena, 1912.)

Börnstein, *Richard*. See Landolt, *Hans Heinrich*.

Bovie, *W. T.* A preliminary note on the coagulation of proteins by the ultraviolet light. (From *Science*, 1913, N.S. 37.)

— The temperature coefficient of the coagulation caused by ultraviolet light. (From *Science*, 1913, N.S. 37.)

Boyle, *Robert*. Memoirs for the natural history of Human Blood,

Especially the Spirit of that Liquor. London 1683. pp. [xvi] + 289. + [vii]. (*Reference.*)

Brislee, *F. J.* An introduction to the study of fuel. London 1912. pp. xxii + 269. ill.

[Brough, *John Cargill.*] "Modern chemistry." ["B" Club Rhyme, 1868.] (*Reference.*)

Browning, *Philip E.* Introduction to the rarer elements. 3rd edition. New York 1912. pp. xii + 232.

Bruni, *G.* Reazioni di doppio scambio in chimica organica. (From the *Atti R. Inst. Veneto Sci.*, 1911, 70.)

— and Amadori, *M.* Sul calore di formazione delle soluzioni solide. (From the *Atti R. Inst. Veneto Sci.*, 1911, 71.)

— and Meneghini, *D.* Sulla formazione di soluzioni solide fra sali alcalini per diffusione allo stato cristallino. (From the *Atti R. Inst. Veneto Sci.*, 1911, 71.)

Butler, *D. B.* Portland cement, its manufacture, testing, and use. 3rd edition. London 1913. pp. x + 458. ill.

Butterfield, *William John Atkinson.* Lectures on chemistry in gas-works. pp. 71. London 1913.

Cahen, *Edward*, and Wootton, *William Ord.* The mineralogy of the rarer metals. A handbook for prospectors. London 1912. pp. xxviii + 211.

Cain, *John Cannell*, and Thorpe, *Jocelyn Field.* The synthetic dyestuffs and the intermediate products from which they are derived. 2nd edition. London 1913. pp. xvii + 423.

Callan, *Thomas.* See Franzen, *Hartwig.*

Canada, *Department of Mines.* Report on the utilization of peat fuel for the production of power. By *B. F. Haanal.* Ottawa 1912. pp. xii + 145. ill.

— Mica: its occurrence, exploitation, and uses. By *Hugh S. de Schmid.* Ottawa 1912. pp. xiv + 411. ill.

Chemical News, *The.* General Index to the Chemical News, Vols. 1 to 100. London 1913. pp. iv + 712. (*Reference.*)

Chemisches Zentralblatt. General Registers über die Jahrgänge 1902–1906, und 1907–1911, Teil II. Berlin 1907, 1913. 2 vols. pp. 1663, 645 to 2040.

Chevreur, *Michel Eugène.* [Liste bibliographique des] Oeuvres scientifique de Michel Eugène Chevreul, 1806–1886. By *Godefroy Malloizel.* Paris 1886. pp. 298.

Claude, *Georges.* Liquid air, oxygen, nitrogen. Translated by *Henry E. P. Cottrell.* London 1913. pp. xxv + 418. ill.

Cohen, *Julius Berend.* Organic chemistry for advanced students Vol. II. London 1913. pp. vii + 427.

Cottrell, *Henry E. P.* See *Claude, Georges.*

Cross, *Charles Frederick*, and *Bevan, Edward John.* Researches on cellulose. III (1905-1910). London 1912. pp. x+173.

Cumming, *Alexander Charles*, and *Kay, Sydney Alexander.* A text book of quantitative chemical analysis. London 1913. pp. xi+382.

Curtius, *Theodor*, and *Franzen, Hartwig.* Ueber die chemischen Bestandteile grüner Pflanzen. Mitteilungen I.-V. (From the *Sitzungsber. Heidelberger Akad. Wiss.*, 1910, 1912.)

Dale, *J.* See *Rothermundt, M.*

Datta, *Rasik Lal.* See *Ray, Prafulla Chandra.*

Davis, *William Alfred.* See *Allen, Alfred Henry.*

Dodgson, *John Wallis*, and *Murray J. Alan.* A foundation course in chemistry for students of agriculture and technology. London 1913. pp. x+244. ill.

Dorn, *Gerhard.* Chymisticum artificium naturæ, Theoricum et practicum. [In 3 parts.] 1568-69. pp. 156, [xvi]+440+[viii]. ill. (*Reference.*)

Drucker, *Carl.* Molekularkinetik und Molarassoziation als physiko-chemische Grundvorstellungen. Leipzig 1913. pp. 33.

Durham College of Science, *Newcastle-upon-Tyne.* [A Description of the Buildings. Newcastle-upon-Tyne 1888.] pp. 16. ill.

Eastick, *John Joseph*, *Ogilvie, James Pettigrew*, and *Lindfield, J. H.* Rapid and accurate determination of traces of iron in cane and best sugar factory and refinery products. (From the *Internat. Sug. J.*, 1912, 14.)

Eaton, *Bertie James.* Camphor from *Cinnamomum Camphora*, (The Japanese Camphor Tree). Cultivation and preparation in the Federated Malay States. (Fed. Malay States. Dep. of Agric. Bull., 1912, No. 15.)

— The preparation of plantation Para rubber. (Fed. Malay States. Dept. of Agric. Bull., 1912, No. 17.)

Echols, *William Holding.* John W. Mallet: scholar, teacher, gentleman. (From the *Alumni Bull. Univ. Virginia*, 1913, [iii], 6.)

Egypt. *Survey Department.* Report on the work of the Laboratories, and of the Assay Office during 1912. By *Alfred Lucas.* pp. 28. Cairo 1913.

Eisenlohr, *Fritz.* Spektrochemie organischer Verbindungen. Molekularrefraktion und -dispersion. Stuttgart 1912. pp. viii+223.

Ettmüller, *Michael.* *Chimia rationalis ac experimentalis curiosa.* Lugduni Batavorum 1684. pp. [viii]+159. (*Reference.*)

Euler, *Hans.* General chemistry of the enzymes. Translated by *Thomas Henry Pope.* New York 1912. pp. ix+323.

Fichter, *Fr.*, *Stutz, Karl*, and *Grieshaber, Fritz.* Ueber die elektro-

lytische Bildung von Harnstoff und von Acetamidin-nitrat. (From the *Verhandl. Naturforsch. Ges., Basel*, 1912, 23.)

Fickendey, *Ernst*. See *Smith, Harold Hamel*.

[Field, *Frederick*.] "C. B," and "A quiet sort of way." ["B" Club Rhymes.] (*Reference*.)

Findlay, *Alexander*. Osmotic Pressure. London 1913. pp. iv + 84.

Fischer, *Emil*, and Klemperer, *Georg*. Ueber eine neue Klasse von lipoiden Arsenverbindungen. (From the *Therapie der Gegenwart*, 1913.)

Fothergill, *James Best*. See *Knecht, Edmund*.

Franzen, *Hartwig*. Exercises in gas analysis. Translated by *Thomas Callan*. London 1913. pp. vii + 120.

— See *Curtius, Theodor*.

Fürth, *Otto von*. Probleme der physiologischen und pathologischen Chemie. II. Band. Stoffwechsellehre. Leipzig 1913.

Gildemeister, *Eduard*, and Hoffmann, *Friedrich*. Die aetherischen Oele. 2nd edition by *E. Gildemeister*. Vol. II. Leipzig 1913. pp. xviii + 713.

— The-volatile oils. Authorised translation by *Edward Kremers*. Vol. I. London 1913. pp. xiii + 677. ill.

Gori, *G*. See *Inghilleri, G*.

Gramont, *Arnaud de*. Nouvel appareil a spectres d'étincelles des liquides sans raies d'électrodes. (From the *Compt. Rend. Assoc. Francaise Avance. Sci.*, 1910.)

— Notice sommaire sur les travaux scientifiques. pp. 36. Paris 1910.

— Sur les spectres stellaires et leur classification. (From the *Annuaire Bur. des Longitudes*, 1911.)

Grieshaber, *Fritz*. See *Fichter, Fr.*

Haanel, *B. F.* See *Canada, Department of Mines*.

Haas, *Paul*, and Hill, *T. G.* An introduction to the chemistry of plant products. London 1913. pp. xii + 401.

Hardisty, *R. H. M.* See *Ruttan, Robert F.*

Harloff, *W. H. Th.*, and Schmidt, *H.* Plantation white sugar manufacture. Translated from the second Dutch edition by *James Pettigrew Ogilvie*. London 1913. pp. vii + 138.

Harrison, *W. H.*, and Sivan, *M. R. Ramaswami*. A contribution to the knowledge of the black cotton soils of India. (From the *Mem. Dept. Agric. India, Chem. Series*, 1912, 2.)

Hatschek, *Emil*. An introduction to the physics and chemistry of colloids. London 1913. pp. ix + 94. ill.

Hatton, *John*. Notes on the therapeutics of radium in the Bath waters. [Bath 1913.]

Henrich, Ferdinand. Theorien der organischen Chemie. Second edition of "Neuere theoretische Anschauungen auf dem Gebiete der organischen Chemie." Braunschweig 1912. pp. xiv + 401.

Henry, Thomas Anderson. The plant alkaloids. London 1913. pp. vii + 466.

Heredia, Carlos E. Observaciones sobre el método crioscópico y relaciones entre los cuerpos simples. Buenos Aires 1912. pp. 244.

Hill, Charles Alexander. Lecture on the function and scope of the chemist in a pharmaceutical works. pp. 43. London 1913.

Hill, T. G. See **Haas, Paul.**

Höfer, Hans von. Das Erdöl und seine Verwandten. 3rd edition. Braunschweig 1912. pp. xvi + 351.

Hoffmann, Friedrich. See **Gildemeister, Eduard.**

Hoffmann, M. K. Lexikon der anorganischen Verbindungen. Vol. I., etc. Leipzig 1910+. (*Reference.*)

Holloway, George Thomas. Notes on the valuation of ores and minerals, and on metallurgical calculations. (From the *Trans. Inst. Min. Met.*, 1911-12.)

Holmberg, Bror. Ueber optisch aktive Dichlorbernsteinsäuren. (From the *Svensk Kem. Tid.*, 1912.)

Hooper, David. The ash of the Plantain (*Musa sapientum*). (From the *J. and Proc. Asiatic Soc.*, Bengal, 1912, 8.)

Hoover, Herbert Clark. See **Agricola, Georgius.**

Hoover, Low Henry. See **Agricola, Georgius.**

Houston, Alexander Cruikshank. See **Metropolitan Water Board.**

Hudson, George S. See **Smith, Harold Hamel.**

Huppert, Karl Hugo. See **Neubauer, Carl Theodor Ludwig.**

India. Report on the progress of Agriculture in India for 1911-12. Calcutta 1913. pp. 65.

Inghilleri, G. Azione dell' anilina sui sali di uranile. (From the *Atti R. Accad. Fisiocritici, Siena*, 1911).

— and **Gori, G.** Su alcuni sali complessi della chinolina con i sali d'uranile. (From the *Atti R. Accad. Fisiocritici, Siena* 1909.)

Jellinek, Karl. Physikalische Chemie der homogenen und heterogenen Gasreaktionen unter besonderer Berücksichtigung der Strahlungs- und Quantenlehre sowie des Nernstschen Theorems. Leipzig 1913. pp. xiv + 844. ill.

Jona, Temistocle. Crioscopia degli estratti di carne. pp. 15. Fossano 1911.

— Ricerca di dipeptidi nelle sostanze estrattive dei muscoli. pp. 19. Fossano 1911.

— Sui composti azotati contenuti nell' estratto di carne. pp. 87. Fossano 1911.

Journal of Industrial and Engineering Chemistry. See American Chemical Society.

Kanolt, *C. W.* Melting points of fire bricks. (*Tech. Papers, Bur. Stands.*, 1912, No. 10.)

Kay, *Sydney Alexander*. See Cumming, *Alexander Charles*.

Kempf, *Richard*. Tabelle der wichtigsten organischen Verbindungen geordnet nach Schmelzpunkten. Braunschweig 1913. pp. xi + 135.

Klemperer, *Georg*. See Fischer, *Emil*.

Knecht, *Edmund*, and Fothergill, *James Best*. The principles and practice of textile printing. London 1912. pp. xvi + 615. ill.

Köhler, *Hippolyt*. Die Fabrikation des Russes und der Schwärze. 3rd edition. Braunschweig 1916. pp. viii + 229. ill.

Komppa, *Gust*. Ueber das γ - γ -dimethylpiperidin. (From the *Ann. Acad. Sci. Fennicæ*, 1911, A, 3.)

Korczyński, *Anton Ritter von*. Die Methoden der Exakten, quantitativen Bestimmung der Alkaloide. Berlin 1913. pp. iv + 82.

Kremann, *R.* The application of physico-chemical theory to technical processes and manufacturing methods. Translated by *Harold E. Potts* and edited by *Albert Mond*. London 1913. pp. xv + 212. ill.

Kremers, *Edward*. See Gildemeister, *E.*

Krogh, *M. von*. See Schilling, *Cl.*

Landolt, *Hans Heinrich*, Börnstein, *Richard*, and Roth, *Walther A.* [With others.] Physikalisch-chemische Tabellen. 4th edition. Berlin 1912. pp. xvi + 1313. (Reference.)

Lasius, *G.* See Bluntschli, *F.*

Legge, *Thomas M.* See Rambousek, *J.*

Lewis, *William*. See Neumann, *Caspar*.

Lewkowitsch, *Julius*. Chemical technology and analysis of oils, fats, and waxes. 5th edition, entirely rewritten and enlarged. Vol. I. London 1913. pp. xxiii + 668. ill.

Liebig, *R. G. Max*. Zink und Cadmium und ihre Gewinnung aus Erzen und Nebenprodukten. Leipzig 1913. pp. xvi + 598. ill.

Lindfield, *J. H.* See Eastick, *John Joseph*.

Liversidge, *Archibald*. The proposed Chemical Laboratory at the University of Sydney. Sydney 1888. pp. 4. ill.

Loew, *Oscar*. See Smith, *Harold Hamel*.

Loschmidt, *Joseph*. Konstitutions-Formeln der organischen Chemie in graphischer Darstellung. Edited by *Richard Anschütz*. (Ostwald's *Klassiker*, No. 190.) Leipzig. pp. 154.

Lucas, *Alfred*. See Egypt, *Survey Department*.

Lunge, *Georg*. The manufacture of sulphuric acid and alkali with the collateral branches. 4th edition. Vol. I. Sulphuric acid. [In three parts.] London 1913. pp. xxiv + 1617. ill. (Reference.)

Lunge, Georg. See **Bluntschli, F.**

Luzzatto, R., and Satta, G. *Intorno al comportamento nell' organismo animale del Parajodanisolo.* (From the *Arch. Farm. speriment.*, 1912, 13.)

M'Intosh, John Geddes. See **Scheele, Karl Wilhelm.**

Mackenzie, John Edwin. *The sugars and their simple derivatives.* London 1913. pp. xvi + 242. ill.

Mallett, John William. See **Echols, William Holding.**

Malloizel, Godefroy. See **Chevreur, Michel Eugène.**

Marggraf, Andreas Sigismund. *Einige neue Methoden, den Phosphor im festen Zustande sowohl leichter als bisher aus dem Urin darzustellen als auch denselben bequem und rein aus brennbarer Materie (Phlogiston) und einem eigentümlichen, aus dem Urin abzuschheidenden Salze zu gewinnen.* Translated from the Latin and French by **Georg Johannes Mielke.** (*Ostwald's Klassiker*, No. 187). Leipzig 1913. pp. 54.

Matthews, J. Merritt. *The textile fibres: their physical, microscopical and chemical properties.* 3rd edition. New York 1913. pp. xi + 630. ill.

Meerwein, H. See **Richter, Victor von.**

Mellor, Joseph William. *A treatise on quantitative inorganic analysis. With special reference to the analysis of clays, silicates, and related minerals. Being Vol. I of a Treatise on the ceramic industries.* London 1913. pp. xxxi + 778. ill.

Meneghini, G. See **Bruni, G.**

Mennicke, Hans. *Die quantitativen Untersuchungsmethoden des Molybdäns, Vanadiums und Wolframs, sowie deren Erze, Stähle. Legierungen und Verbindungen.* Berlin 1913. pp. 231.

Metropolitan Water Board. *Ninth research report.* By **Alexander Cruikshank Houston.** pp. 26. London 1913.

Mielke, Georg Johannes. See **Marggraf, Andreas Sigismund.**

Mingaye, John Charles Henderson. See **Anderson, C.**

Mitchell, C. Ainsworth. *Mineral and aerated waters.* London 1913. pp. xiii + 227. ill.

Miyake, K. *Ueber das Verhalten der Pentosane und Methylpentosane der Samen von Glycine hispida und von Phaseolus vulgaris während des Keimungsvorganges.* (From the *J. Coll. Agric., Tohoku Imp. Univ., Sapporo, Japan*, 1912, 4.)

— *An improvement of the method for the determination of Galactan.* (From the *J. Coll. Agric., Tohoku Imperial University*, 1912.)

Molinari, Ettore. *Treatise on general and industrial organic chemistry.* Translated from the 2nd Italian edition by **Thomas Henry Pope.** London 1913.

Mond, Albert. See **Kremann, R.**

Montamy, d'Archais de. *Traité des couleurs pour la peinture en émail et sur la porcelaine.* Paris 1765. pp. lii + 287. (*Reference.*)

Moureu, Charles. *Notions fondamentales de chimie organique.* 4th edition. Paris 1913. pp. vi + 383.

Murray, J. Alan. See **Dodgson, John Wallis.**

Nazari, Giovanni Battista. *Della Tramutatione metallica sognit tre, . . Nel primo d'i quali si tratta della falsa tramutatione sofistica : Nel secondo della utile tramutatione detta reale usuale : Nel terzo della diuina tramutatione detta reale Filosofica.* Con un copioso Indice per ciascun sogno de gl' Auttori, & opre c'hanno sopra cio trattato. In Brescia 1572. pp. [viii] + 167 + [viii]. (*Reference.*)

Neubauer, Carl Theodor Ludwig, and Huppert, Karl Hugo. *Analyse des Harns.* 11th edition. 2nd half. Wiesbaden 1913. pp. xxi + 683 to 1657. ill.

Neumann, Caspar. *Chemical Works.* Abridged and methodized ; with large additions . . . by **William Lewis.** London 1759. pp. xvi + 586 + [xxxviii]. (*Reference.*)

Nicholls, Lucius. See **Smith, Harold Hamel.**

Odén, Sven. *Der Kolloide Schwefel.* (From the *Nova Acta Regiae Soc. Sci. Upsala*, 1913, [iv], 3.)

Ogilvie, James Pettigrew. See **Eastick, John Joseph.**

— See **Harloff, W. H. Th.**

Osterhout, W. J. V. *Plants which require sodium.* (From the *Bot. Gaz.*, 1912, 54.)

Ostwald's Klassiker. See **Loschmidt, Joseph,** and **Marggraf, Andreas Sigismund.**

Ottolenghi, Donato. *Ueber die Wirkung der Säuren der Basen und einiger Salze auf die bakteriziden Sera.* (From the *Zeitsch. Immunitätsforsch. exp. Ther.*, 1912.)

Parnas, Jakob. *Ueber Bildung von Glykogen aus Glycerinaldehyd in der Leber.* (From the *Zentr. Physiol.*, 1912, 26.)

Phillips, Richard. See **Annals of Philosophy.**

Pick, Hans. See **Auerbach, Friedrich.**

Planck, Max. *Vorlesungen über die Theorie der Wärmestrahlung.* 2nd edition. Leipzig 1913. pp. xii + 206.

Plimmer, Robert Henry Aders. *The chemical constitution of the proteins.* 2nd edition. Part II. London 1913. pp. xii + 107.

Pope, Thomas Henry. See **Euler, Hans.**

— See **Molinari, Ettore.**

Porritt, Benjamin Dawson. *The chemistry of rubber.* London 1913. pp. vii + 96.

Potts, Harold E. See **Kremann, R.**

Pranke, Edward J. Cyanamid. Manufacture, chemistry and uses. Easton, Pa. 1913. pp. vi + 112.

Preyer, Axel. See **Smith, Harold Hamel.**

Pusa, Agricultural Research Institute. Report, 1911-12 (Including Report of the Imperial Cotton Specialist). Calcutta 1913. pp. 113.

Rambousek, J. Industrial poisoning from fumes, gases and poisons of manufacturing processes. Translated and edited by **Thomas M. Legge.** London 1913. pp. xiv + 360.

Rây, Prafulla Chandra, and Datta, Rasik Lal. On isomeric allyl-amines. (From the *J. and Proc., Asiatic Soc. Bengal*, 1912, N.S. 8.)

Redgrove, Herbert Stanley. See **Alchemical Society.**

Richter, Victor von. Chemie der Kohlenstoffverbindungen oder organische Chemie. Vol. II. Carbocyclische und heterocyclische Verbindungen. Edited by **Richard Anschütz** and **H. Meerwein.** 11th edition. Bonn 1913. pp. xxii + 1048. (*Reference.*)

Roscoe, Sir Henry Enfield. Description of the Chemical Laboratories at the Owens College, Manchester. 3rd edition. Manchester 1881. pp. 4. ill.

— and **Schorlemmer, Carl.** A treatise on chemistry. Vol. II. The metals. New edition completely revised. London 1913. pp. xvi + 1470. ill. (*Reference.*)

Roth, Walther A. See **Landolt, Hans Heinrich.**

Rothermundt, M., and Dale, J. Experimentelle Studien über die Wirkungsweise des Atoxyls in vitro und im Tierkörper. (From the *Zeitsch. Immunitätsforsch. exp. Therapie*, 1912, 12.)

Roux, Ulysse. La grande industrie des acides organiques. Bitartrate de potasse ou crème de tartre. Acid tartrique. Acide citrique. Paris 1912. pp. viii + 544. ill.

Royal Society of London. Catalogue of the Periodical Publications in the Library. London 1912. pp. viii + 455. (*Reference.*)

— The celebration of the two hundred and fiftieth anniversary, July 15-19, 1912. London 1913. pp. iv + 128. (*Reference.*)

Rupp, E., and Kropat, K. Ueber eine einfache Bestimmung des Gesamtquecksilbers in Hydrargyrum salicylicum. (From the *Apoth. Zeit.*, 1912.)

Ruttan, Robert F., and Hardis y, R. H. M. A new reagent for detecting occult blood. (From the *Canadian Med. Assoc. J.*, 1912.)

Rutty, John. Methodical synopsis of mineral waters, comprehending the most celebrated medicinal waters, both cold and hot, of Great Britain, Ireland, France, Germany . . . and several other parts of the World. . . . Interspersed with tables. London 1757. pp. xvi + 660 + [viii]. (*Reference.*)

Sabatier, *Paul*. Die Hydrierung durch Katalyse. Leipzig 1913. pp. 20.

Sack, *J.* See Smith, *Harold Hamel*.

Salter, *Charles*. See Scheithauer, *W.*

Satta, *G.* See Luzzatto, *R.*

Schär, *Eduard*. Ueber Reaktionen des Hydrocoerulignons. (From the *Schweiz. Woch. Chem. Pharm.*, 1912.)

Scheele, *Karl Wilhelm*. The chemical essays of . . . Translated from the Transactions of the Academy of Sciences at Stockholm. First published . . . in 1786. [Re-issued] with a sketch of the life of Karl Wilhelm Scheele by *John Geddes M'Intosh*. London 1901. pp. xxx + 294.

Scheithauer, *W.* Shale oils and tars, and their products. Translated by *Charles Salter*. London 1913. pp. viii + 183. ill.

Schilling, *Cl.*, Krogh, *M. von*, Schrauth, *W.*, and Schoeller, *W.* Die Wirkung organischer Quecksilberverbindungen bei Spirochäteninfektionen. (From the *Zeitsch. Chemotherapie u. verwandte Gebiete*, 1912, 1.)

Schirmer, *Wolfgang*. Beiträge zur chemischen Kenntnis der Gummi- und Schleimarten. pp. 67. Strassburg i.E. 1911.

Schmid, *Hugh S. de*. See Canada, *Department of Mines*.

Schmidt, *Ernst*. Ueber das Kreatinin. (From the *Apoth. Zeit.*, 1912).

——— Ueber die Darstellung des Glycoeyamidins. (From the *Zeitsch. Allg. Oesterr. Apothekervereins*, 1912.)

—— and Seeberg, *A.* Ueber das Neuriubromid. (From the *Apoth. Zeit.*, 1912.)

Schmidt, *H.* See Harloff, *W. H. Th.*

Schoeller, *Walter*, and Schrauth, *Walther*. Neuere Anschauungen über den Chemismus der Gift- und Heilwirkung organischer Quecksilberverbindungen. (From the *Med. Klinik*, 1912.)

Schoeller, *Walter*. See Schilling, *Cl.*

Schorlemmer, *Carl*. See Roscoe, *Sir Henry Enfield*.

Schottky, *Hermann*. Ueber die Veränderungen von Blattmetallen beim Erhitzen infolge von Oberflächenkräften. (From the *Nachr. k. Ges. Wiss. Göttingen*, 1912.)

Schrauth, *W.* See Schilling, *Cl.*

—— See Schoeller, *Walter*.

Schröder, *F.* Beitrag zur Kenntnis der ölhaltigen Samen von *Ximenia Americana*. (From the *Arb. Kais. Gesund.*, 1912, 43.)

—— Ueber den Nachweis von weissem Phosphor in Zündwaren. (From the *Arb. K. Gesundheit*, 1913, 44.)

Schulte im Hofe, *August*. See Smith, *Harold Hamel*.

Schwarzkop, *Paul*. Beiträge zur Kenntnis der komplexen Eisen-cyanverbindungen mit besonderer Berücksichtigung der Bildung von

Nitroprussid. (From the *Abhandl. deut. naturwiss.-med. Ver. Böhmen*, 1911, 3.)

Seeberg, A. See Schmidt, Ernst.

Shepherd, John William. Qualitative determination of organic compounds. London 1913. pp. xvi + 348. ill.

Sivan, M. R. Ramaswami. See Harrison, W. H.

Smith, Harold Hamel [Editor]. The fermentation of cacao. With which is compared the results of experimental investigations into the fermentation, oxidation, and drying of coffee, tea, tobacco, indigo, etc., for shipment. By the following authorities: Axel Preyer, Oscar Loew, Ernst Fickendey, August Schulte im Hofe, J. Sack, Geo. S. Hudson, and Lucius Nicholls. London 1913. pp. lvi + 318. ill.

Soddy, Frederick. The chemistry of the radio-elements. London 1911. pp. iv + 92.

Solaro, Alessandro. Studio microscopico e chimico pel riconoscimento delle fibre vegetali, lane, peli, pelliccie, sete naturali, sete artificiali. Milano 1914. pp. 432. ill.

Stähler, Arthur. [Editor]. Handbuch der Arbeitsmethoden in der anorganischen Chemie. Vol. I. Leipzig 1913. pp. xii + 786. ill. (Reference.)

Stoll, Arthur. See Willstätter, Richard.

Stutz, Karl. See Fichter, Fr.

Sydney, University of. See Liversidge, Archibald.

Tables annuelles de constantes et données numériques de chimie, de physique et de technologie. Publiées sous le patronage de l'Association internationale des Académies par le Comité international nommé par le VII^e Congrès de Chimie appliquée (Londres, 2 Juin, 1909). Volume II. Année 1911. Paris 1913. pp. xl + 759. (Reference.)

Tadokoro, T. Ueber die Enzymatischen Wirkungen der Frischen Nahrungs- und Genussmittel. (From the *J. Coll. Agric., Tohoku Imp. Univ., Sapporo, Japan*, 1913, 5.)

Tammann, G. Zur Thermodynamik der Gleichgewichte in Einstoffsystemen. (From the *Nachr. k. Ges. Wiss. Göttingen*, 1911).

— Ueber die Abhängigkeit der Krystallform von der Temperatur und die Rekrystallisation in Konglomeraten. (From the *Nachr. K. Ges. Wiss. Göttingen*, 1912.)

Thomson, Thomas. See *Annals of Philosophy*.

Thorpe, Sir Edward. A dictionary of applied chemistry. Vols. IV. & V. London 1913. pp. viii + 727, viii + 830. ill. (Reference.)

Thorpe, Jocelyn Field. See Cain, John Cannell.

Thresh, John C. The examination of waters and water supplies. 2nd edition. London 1913. pp. xx + 644. ill.

Thurneisser, Leonhardt. Προκατάληψις oder Præoccupatio, Durch zwölf verschiedene Tractaten, gemachter Harm Proben. Das 59 Buch. Franckfurt 1571. pp. [iv] + lxxxv + [ii]. (*Reference.*)

Tilden, Sir William Augustus. The progress of scientific chemistry in our own times. With biographical notes. 2nd edition. London 1913. pp. xii + 366.

Valenti, Adriano. Contributo allo studio del comportamento nell' organismo di alcuni derivati arsenicali organici (salvarsan e cacodilato di sodio. (From the *Arch. Farm. speriment.*, 1912, 11.)

Vassiliev, A. M. The origin of the names of the chemical elements. An attempt at a compilation. pp. 40. Kasan 1912. [In Russian.]

Vavon, Gustave. Réductions catalytiques en présence de noir de platine. Application a la transformation en alcools des aldéhydes et des cétones. Toulouse 1913. pp. 107.

Venth, Ernst. Ueber emulsinartige Enzyme. pp. 53. Strassburg, i.E. 1912.)

Werner, Alfred. Neuere Anschauungen auf dem Gebiete der anorganischen Chemie. 3rd edition. Braunschweig 1913. pp. xx + 419.

West Indies, Imperial Department of Agriculture. Sugar-cane experiments in the Leeward Islands. pp. 111. Barbados 1913.

White, Edmund. Lecture on thorium and its compounds. Delivered before the Institute of Chemistry. London 1912. pp. 28.

Willstätter, Richard, and Stoll, Arthur. Untersuchungen über Chlorophyll, Methoden und Ergebnisse. Berlin 1913. pp. viii + 424. ill.

Wootton, William Ord. See **Cahen, Edward.**

Wren, Henry. Organometallic compounds of zinc and magnesium. London 1913. pp. viii + 100.

INDEX TO AUTHORS' NAMES.

- Abram, H. H., 150, 197.
 Agashe, G. S., 261.
 Akers, N. C., 197.
 Applebey, M. P., 24, 361.
 Atack, F. W., 195.
 Atkins, W. R. G., 194, 303.
 Auld, S. J. M., 14.

 Bain, (Miss) A. M., 309.
 Bainbridge, E. G., 4.
 Baker, F., 244.
 Baker, H. B., 298.
 Balls, W. C., 150, 197.
 Baly, E. C. C., 201, 216.
 Banerji, H., 235.
 Barger, G., 128.
 Barker, M. F., 152.
 Barker, T. V., 62.
 Barrett, F. L., 270.
 Barrett, W. H., 132.
 Barrow, F., 228.
 Bartlett, (Miss) D. J., 217.
 Bassett, H. L., 56.
 Baxter, R. R., 284.
 Beesley, R. M., 346.
 Bell, N. M., 383.
 Benson, P., 378.
 Bingham, E. C., 113.
 Bissett, C. C., 233, 263.
 Blackstock, G., 74.
 Bourdillon, R., 124, 252.
 Bousfield, W. R., 3, 371.
 Brady, O. L., 248, 253.
 Bramley, A., 123.
 Branch, G. E. K., 29.
 Braunnigan, P. J., 58.
 Brazier, S. A., 272.
 Bredt, J., 356.
 Burgen, P., 300.
 Burgess, M. J., 376.
 Burrows G. J., 264.

 Cain, J. C., 77, 172, 289, 380.
 Campbell, C., 130.
 Campbell, L. E., 128.
 Cardwell, D., 150, 244.
 Carr, F. H., 226.
 Caw, W., 246.
 Challenger, F., 76.

 Chapman, A. C., 122, 182.
 Chapman, D. L., 24, 75.
 Chattaway, F. D., 284, 304, 383.
 Chatterji, B., 235.
 Clark, A. H., 250.
 Clarke, G., 27.
 Clarke, H. T., 161, 249.
 Clewer, H. W. B., 285.
 Clough, G. W., 109, 352, 357.
 Coade, (Miss) M. E., 188.
 Collie, J. N., 22, 79, 217.
 Constable, A. B., 304.
 Coppin, N. G. S., 352.
 Coulthard, A., 289.
 Courtman, H. R., 168.
 Crompton, H., 224.
 Crossley, A. W., 169, 170, 217, 352, 369.
 Crowther, H. L., 68.
 Cumming, A. C., 77, 153.
 Cundall, J. T., 344.
 Cunningham, (Miss) M., 104.

 Dakin, H. D., 156, 192.
 Dale, (Miss) A. B., 55.
 Datta, R. L., 79, 185.
 Davies, M. J. P., 250.
 Dawson, H. M., 130, 308.
 De, R., 185.
 Denham, W. S., 251, 261.
 Dey, B. B., 154, 155.
 Dey, M. L., 283.
 Dhar, N., 185.
 Dickson, T. W., 171, 185.
 Dixon, A. E., 113.
 Dobbie, J. J., 180.
 Dorée, C., 104, 222.
 Drugman, J., 252.
 Dudley, H. W., 156, 192.
 Dunn, F. P., 248.
 Dunstan, A. E., 174, 378.
 Dutt, B. C., 235.
 Dyer, (Miss) G., 55.

 Earl, J. C., 164.
 Elsdon, A. V., 173.

 Fargher, R. G., 72.
 Fawsitt, C. E., 264.
 Findlay, A., 115, 173, 250.

Finlay, T. M., 153.
 Firth, J. B., 111.
 Fleck, A., 7, 172, 383.
 Fletcher, A. L., 134.
 Forster, M. O., 24, 104, 150, 152, 244.
 Forsyth, W. O., 284.
 Fort, M., 270.
 Foulds, R. P., 261.
 Fowler, G. J., 156.
 Fox, J. J., 180, 194.
 Francis, F., 249, 302.
 Frankland, E. P., 158.
 Furlong, J. R., 128.

Garner, W. E., 198.
 Garrett, C. S., 7, 225.
 Geake, F. H., 249.
 Ghosh, K. N., 9.
 Gilling, C., 286.
 Gilmour, R., 108, 363.
 Gluud, W., 118, 177, 190, 244.
 Goulding, E., 197.
 Gray, F. W., 376.
 Green, A. G., 66, 116, 152, 275, 276.
 Gupta, N. M., 361.
 Gupta, N. N. S., 269.

Haas, P., 228.
 Harper, E. M., 304.
 Hartley, E. G. J., 188.
 Hartley, H., 132, 252.
 Haworth, W. N., 193, 223, 356.
 Heilbron, I. M., 59, 226, 245, 354, 381.
 Henderson, G. G., 246, 354, 381.
 Henderson, J. A. R., 226, 354.
 Hewitt, J. T., 30, 160, 251.
 Higgins, S. H., 253, 302.
 Hollely, W. F., 6.
 Holmes, J., 362.
 Holmyard, E. J., 159.
 Holt, A., 61, 383.
 Hope, E., 63, 224.
 Hopwood, A., 345.
 Hulme, W., 117, 307.
 Hynd, A., 306.

Irvine, J. C., 7, 69, 70, 71, 306.

James, T. C., 173, 196.
 Jana, S. C., 28, 234, 283.
 Jarrard, W. J., 106.
 Johnson, (Miss) R. M., 251.
 Johnson, W., 276.
 Jones, B. M., 160.
 Jones, D. T., 376.
 Jones, W. J., 5.
 Joseph, A. F., 72.
 Jowett, H. A. D., 26.
 Joyner, R. A., 282.
 Judd, C. W., 196.

Kay, F. W., 131.

Kempf, R., 244.
 Kenner, J., 10, 105.
 Kenyon, J., 266, 296, 348.
 King, G., 8, 173.
 Kipping, F. S., 280, 348, 374.
 Knight, W. A., 282.
 Krall, H., 189, 377.

Lankshear, F. R., 224.
 Lapworth, A., 5, 154, 175, 289.
 Lefebure, V., 368.
 Le Suenr, H. R., 189, 306.
 Levy, S. I., 74, 159, 353.
 Lewcock, W., 127.
 Lingford, H. M., 5.
 Lowry, T. M., 168, 171, 185, 221, 348.
 Lubrzynska, (Miss) E., 174.

Macbeth, A. K., 11, 58, 77, 161, 304.
 McClelland, N. P., 26, 132.
 McCombie, H., 8, 63, 283.
 Macdonald, J. L. A., 260.
 McKenzie, A., 109, 228.
 Mackenzie, J. E., 175.
 Macleod, J., 77.
 Madsen, E. H., 129.
 Mann, (Miss) G. R., 30.
 Marsh, J. E., 62.
 Marshall, A., 157.
 Marshall, H., 14, 54.
 Martin, G., 190.
 Masson, I., 233.
 Masters, (Miss) H., 76.
 May, P., 360.
 Meldola, R., 6, 160, 248.
 Merriman, R. W., 33, 68, 257, 258, 259
 260.
 Merton, T. R., 4, 284.
 Micklethwait, (Miss) F. M. G., 232,
 289.
 Mills, (Mrs.) M., 126.
 Mills, W. H., 126, 309.
 Mitchell, A. D., 67.
 Morgan, G. T., 133, 229, 232, 247, 371
 373, 374, 379.
 Morrell, G. F., 300.
 Moss, H. W., 371, 373.
 Mosserop, T. D., 14.
 Mukerjee, K. C., 268.
 Mukherjee, H., 185.
 Mumford, E. M., 79, 156.
 Mussell, A. G., 174.
 Myers, J. E., 61.

Nair, T. K., 151.
 Naunton, W. J. S., 301.
 Neogi, P., 112.
 Nolan, T. J., 53, 151, 197.

Parker, A., 130.
 Parker, L. H., 298, 299.

- Patterson, H. S., 22, 79, 217.
 Patterson, T. S., 284.
 Patterson, W. H., 172.
 Peacock, D. H., 109.
 Peddle, C. J., 119.
 Perkin, A. G., 9, 110, 253, 354.
 Perkin, W. H., jun., 72, 74, 223, 259, 290, 356.
 Perkins, W. H., 302.
 Philip, J. C., 28, 123.
 Pickard, J. A., 229.
 Pickard, R. H., 127, 266, 296, 348.
 Pickering, S. U., 191, 192.
 Pickles, S. S., 164.
 Pictet, A., 131.
 Platt, C. B., 250.
 Pollard, C. T., 349.
 Pope, F. G., 191, 194, 251, 378.
 Pope, W. J., 78, 247, 259, 382.
 Porter, T. C., 4.
 Powell, C. W. R., 264.
 Power, F. B., 2, 63, 180, 372.
 Powis, F., 308.
 Pratt, W. R., 169.
 Price, T. S., 272.
 Proctor, H. R., 370.
 Purvis, J. E., 26, 132, 253, 303.
 Pyman, F. L., 26, 125, 126, 226.

 Rakshit, J. N., 195.
 Ramsay, (Sir) W., 21.
 Rây, P. C., 28, 185, 234, 283.
 Read, J., 78, 247, 382.
 Reilly, J., 133, 247, 379.
 Remfry, F. G. P., 72.
 Renouf, (Miss) N., 369.
 Reverdin, F., 248.
 Rhead, T. F. E., 51, 193.
 Rhymes, W. C., 62.
 Rice, F. O., 216.
 Rindl, M., 263.
 Robertson, P. W., 221, 248.
 Robinson, (Mrs.) G. M., 266.
 Robinson, R., 63, 261, 266, 290.
 Robison, R., 348, 374.
 Rogerson, H., 180.
 Rowe, F. M., 66, 152, 275.
 Ruhemann, S., 74, 159.
 Rule, A., 154, 380.

 Salway, A. H., 2, 59, 63, 170, 287, 372.
 Scharff, G. E., 374.
 Scott, A., 124.
 Scott, J. P., 70, 71.
 Segaller, D., 159, 246, 305, 379.
 Sen, K. B., 349.
 Sen-Gupta, H. K., 29, 155, 382.
 Shah, P. G., 160.
 Shipsey, (Miss) K., 117, 194.
 Sidgwick, N. V., 265.
 Simonsen, J. L., 26, 126, 172, 380.

 Singh, B. K., 109.
 Smedley, (Miss) I., 174.
 Smiles, S., 53, 151, 197.
 Smith, C., 67, 172.
 Smith, H. E., 158.
 Smith, H. L., 76.
 Smith, S., 170.
 Smith, T. A., 280.
 Smyth, (Miss) W. R., 224.
 Stansfield, J. F., 173.
 Starling, W. W., 128.
 Stephen, H., 14, 196, 261.
 Stewart, A. W., 11, 58, 77, 161.
 Still, C. J., 262.
 Stubbs, C. M., 225.

 Taylor, (Miss) C. M., 259.
 Taylor, J., 113.
 Thole, F. B., 32, 174, 378.
 Thomas, E. R., 32.
 Thomas, J. S., 154, 380.
 Thomson, R. F., 7.
 Thorpe, J. F., 5, 253, 254, 255, 256, 257, 259, 346.
 Tinkler, C. K., 114, 278.
 Titherley, A. W., 29, 109, 352.
 Turner, T., 151.
 Turner, W. E. S., 119, 233, 263, 349.
 Tutin, F., 180, 228, 278, 285, 301.
 Twiss, D. F., 356.
 Tyrer, D., 252.

 Underhill, L. K., 75.

 Vanstone, E., 262.
 Vlieland, C. A., 252.

 Wallace, T. A., 194.
 Wallach, O., 223.
 Ward, P. J., 283.
 Warner, C. H., 60.
 Watson, E. R., 9, 28, 268, 269, 280, 348, 349.
 Weizmann, C., 14, 196, 261.
 Werner, E. A., 117, 132, 188, 194, 287.
 Wheeler, R. V., 51, 193, 250, 376.
 Willett, (Miss) W. I., 191.
 Williams, H. E., 10, 32, 54.
 Williams T., 115.
 Willson, F. G., 302.
 Wilsdon, B. H., 265.
 Wilson, F. J., 59, 245.
 Witham, E., 10.
 Withers, J. O., 24.
 Wood, A. S., 5, 253, 254, 255, 256, 257.
 Woodhouse, (Miss) H., 251, 261.
 Worley, R. P., 359, 360.
 Wren, H., 262.
 Wright, R., 63, 280, 375.

 Yates, J., 127.

INDEX TO DISCUSSIONS.

Bone, W. A., 53.
 Bourdillon, R., 125.
 Bousfield, W. R., 3.

Chapman, A. C., 123, 181.
 Christie, J. H., 106.
 Cross, C. F., 105, 223.
 Crossley, A. W., 170.

Donnan, F. G., 53, 369, 371, 372.
 Dreaper, W. P., 369.

Flürscheim, B., 169, 216.

Hewitt, J. T., 66, 277.
 Hooper, E. G., 181.

Keane, C. A., 300.
 Kenner, J., 106.

Lowry, T. M., 185.

Meldola, R., 222.
 Merriman, R. W., 25.
 Morrell, G. F., 301.

Parker, L. H., 300.
 Power, F. B., 182.

Ramsay, (Sir) W., 298.
 Robertson, P. W., 222.

Salway, A. H., 171.
 Seligman, R., 170.
 Senter, G., 299.
 Slade, R. E., 299.
 Smithells, A., 52.

Thole, F. B., 67.
 Thorpe, J. F., 347.
 Tinkler, C. K., 279.

Worley, F. P., 123.

INDEX OF SUBJECTS.

- Absorption spectra. See under Spectra.
- Acenaphthene and its monohalogen derivatives, refractivities of, 224.
- Acetamide, cyano-, condensation of, with *cyclohexanones*, 256.
- Acetic acid, ethyl ester, densities of mixtures of ethyl alcohol and, 259. mutual solubilities of water and, 259. azeotropic mixture of ethyl alcohol, water, and, 259, 260.
- Acetic acid, *diamino*-, dibenzoyl derivative, 228.
- bromo-, action of sodium hydroxide and methoxide on, 129.
- cyano-, ethyl ester, condensation of, with acid chlorides, 261.
- Acetic anhydride, rate of hydration of, 265.
- Acetoacetic acid, ethyl ester, condensation of, with acid chlorides, 261.
- sodium derivative, action of $\alpha\gamma$ -dibromobutane on, 72.
- Acetone, purification of, 194.
- condensation of glucose and, 260.
- of crystallisation, double salts with, 62.
- Acetonedicarboxylic acid, condensation of, with phenols, 154.
- Acetylacetone, influence of, on ionic reactions, 30.
- metallic derivatives, and their absorption spectra, 371, 373.
- Acetyl mesityl oxide, metallic derivatives of, 373.
- Acids, catalytic activity of, 308.
- and their salts, relation between the absorption spectra of, 63.
- organic, action of sulphur chloride and of thionyl chloride on metallic salts of, 261.
- halogen-substituted, reactions of, 129.
- Acid chlorides, condensation of, with ethyl cyanoacetate, ethyl malonate, and ethyl acetoacetate, 261.
- Aconitine, constitution of, 253.
- Adams, M. A., reference to decrease of, 167.
- Adipic acid, $\alpha\delta$ -dibromo-, methyl and ethyl esters, 14.
- Affinity, residual, and co-ordination, 371.
- relation between chemical constitution and, 249
- Alcohol. See Ethyl alcohol.
- Alcohols, aliphatic, molecular condition of mixtures of water and, 194.
- of the formula $C_2H_5 \cdot CH(OH) \cdot R$, rotatory powers of, 266.
- See also Carbinols.
- Aldehydes, aromatic, condensation of pyruvic acid with, 174.
- α -ketonic, conversion of α -amino-acids into, 192.
- conversion of α -hydroxy-acids into, 156.
- unsaturated, absorption spectra of, 26.
- α -Aldehydophenylglycine and its amide and their oximes, 190.
- Alkali haloids, solubilities of, in alcohols, 263.
- metals, polysulphides of the, 380.
- Alkaline earth metals, double carbonates of, with potassium carbonate, 185.
- Alkaloids of ipecacuanha, 226.
- Alkyl groups, replacement of, in tertiary aromatic bases, 257.
- iodides, rate of interaction of sodium phenoxide and, 159.
- sodium thiosulphates, action of hydrogen peroxide on, 356.
- Allantoin, constitution of, 109.
- Alloys, fractionation of, 134.
- Allyl alcohol, mechanism of production of, from glycerol and oxalic acid, 383.
- Allylamine derivatives, 118.
- N*-Allylglycine and its copper salt, 177.

- Alpinia alba*, oil of the fruits of, 164.
 Amalgams. See Mercury alloys.
 Amides, secondary and tertiary, preparation of, 195.
 Amines, coloured liquid mixtures of nitro-compounds and, 278.
 aromatic, viscosity of, 32.
 externally compensated, new method for resolving, 78.
 secondary, preparation of, from dicarboxylic acids, 189.
 Amine nitrites, preparation of, 112.
 Amino-acids, esters, action of, on ethyl dicarboxylglutamate, 353.
 α -Amino-acids, conversion of, into α -ketonic aldehydes, 192.
 Annulide, formation of, 287.
 Ammonium base, investigation of the change of carbinol into, 114.
 Ammonium bases, solubilities of salts of, 119.
 substituted, platini-iodides and cupri-iodides of, 79.
 iodide, action of heat on, 61.
 nitrate, vapour density of, 28, 234.
 organic salts, quaternary, influence of the constitution of tertiary bases on the rate of formation of, 32.
 acetate and benzoate, vapour density of, 234.
 cyanate, mechanism of the transformation of, into carbamide, 132.
 thiocyanate, production of guanidine thiocyanate from, 189.
 Anhydrides, preparation of, 261.
 rate of hydration of, 265.
 Anhydrocetamine-acetophenone, constitution of, 63.
 Aniline, derivatives of, absorption spectra of, 253.
 alkyl derivatives, preparation of, 189.
 Aniline, *m*-bromo-, and *m*-iodo-, action of chlorine on, 283.
 2:4:6-trichloro-3-iodo-, 283.
 p-iodo-, derivatives of, 304.
 o-nitro-, constitution of, 78.
 oxidation of, 275.
 Aniline-black, constitution of, 276.
 Anilines, nitro-, quinonoid salts of, 66.
 Aniline-*p*-sulphonic acid, solubility of, and its hydrates, 28.
 α -Anilinostearic acid, resolution of, 306.
p-Anisidines, trinitro-, constitution of the, 248.
 Anisole, trinitro-, absorption spectrum of, 216.
 Anniversary dinner, 94.
 Antipyrinediazonium salts and their azo-derivatives, 133.
 azo-derivatives from, 247.
 Aromatic compounds, from the hydro-aromatic series, 369.
 Association and viscosity, 32.
 Atomic weights, report of the International Committee on, 240.
 table of, 243.
 Atropine, absorption spectrum of, 180.
 Azo-compounds, hydroxy-, 226.
 Azomethine compounds, colour and constitution of, 191.
 Azonium compounds, quaternary, optical resolution of, 109.
p-Azophenol, isomerism of, 221.
 Bacterium, a new iron, 79.
 Barium potassium carbonate, 186.
 Barret, E. L., reference to decease of, 274.
 Bases, cyclic, formation of, 224.
 tertiary, influence of the constitution of, on the rate of formation of quaternary ammonium salts, 32.
 tertiary aromatic, replacement of alkyl groups in, 257.
 Beech-wood, action of ozone on, 104.
 Bell, J. C., reference to decease of, 274.
 Benzaldehyde, derivatives of, absorption spectra of, 253.
 Benzaldoximes, nitro-, 248.
 Benzene derivatives, absorption spectra of, 132.
 thio-derivatives, absorption spectra of, 194.
 Benzene, trinitro-, absorption spectrum of, 216.
 Benzeneazobenzeneazophenol, *p*-nitro-, 191.
 Benzeneazocarbonylcoumarone and its derivatives, 258.
 3- and 4-Benzenesulphonyl 3:4-tolylene-diamines and -diazoides, 374.
 Benzerythrene, synthesis of derivatives of, 289.
 Benzidine, *o*-dinitro-derivatives, isomeric, absorption spectra of, 77.
 oxidation of, 276.
 derivatives of, 289.
 Benzildioximes, nickel salts of, 195.
 Benzilmethylhydrazine, 150.
 Benzoic acid, *m*-chloro-, preparation of, and its hydroxylamine salt, 244.
 p-nitro-, borneol and isoborneol esters, 381.
 Benzoic anhydride, rate of hydration of, 265.
 Benzoin synthesis, mechanism of the, 266.
 Benzophenone, 2:3:4:2'-tetrahydroxy-, derivatives of, 269.
 Benzoylactic acid, ethyl ester, sodium derivatives, action of $\alpha\gamma$ -dibromobutane on, 72.

- Benzoylmandelic acid, ethyl ester, 268.
 Benzoyl-*o*-nitromandelonitrile, 268.
 Benzylidenemannose, 307.
 Benzylidenemethylglucosamine hydrochloride, 306.
 Benzylidenemethylglucoside and its isomeride, 71.
 5:5'-Bisbenzeneazo-2:2'-diphenol, 248.
 Bismuthinitrites, 150.
 Bismuth organic compounds, 76.
 Biuret, decomposition of, by heat, 287.
 Bleaching, dynamics of, 258.
 Borneol and *isoborneol*, *p*-nitro-benzoates of, 381.
 Bornylene, oxidation of, 246.
 Bromine, preparation of pure, 124.
 Polybromides, existence of, 72.
 Butane, $\alpha\gamma$ -dibromo-, action of, on the sodium derivatives of ethyl acetate and benzoylacetate, 72.
 action of, on the sodium derivative of ethyl malonate, 74.
*iso*Butane. See β -Methylpropane.
 Butyric anhydride, rate of hydration of, 265.
 Cadmium, rate of volatilisation of, 151.
 Cæsium nitrite, 197.
 acetylacetone, 373.
 Calcium salts, behaviour of, with soap solutions, 76.
 potassium carbonate, 187.
 hypochlorite, bleaching action of solutions of, 302.
 hyponitrite, conductivity of, 185.
 Calorimeter, an adiabatic, 376.
 Camphane series, studies in the, 104.
l- β -Camphor. See *l*-Epicamphor.
 Camphorquinone, condensation of, with phenols, 155.
 configuration of the eight oximino-derivatives of, 104.
 Camphorquinone- α - and β -methylhydrazones, 150.
l-Canadine α - and β -methochlorides, 26.
 Cantharene, 193.
 Cantin, A., reference to decease of, 274.
 Carbamide, decomposition of, 264, 287.
 transformation of ammonium cyanate into, and decomposition of, by heat, 132.
 condensation of chloral hydrate acid, 352.
o-Carbamylphenoxyacetic acid, 258.
 Carbinol, investigation of the change of, into ammonium base, 114.
 Carbinols, $\text{CH}_3\cdot\text{CH}(\text{OH})\cdot\text{R}$, configuration of, 337.
 esters of, 296.
 Carbon, mode of combustion of, 51, 193.
 new oxide of, 106.
 Carbon monoxide, properties of, 33.
 dioxide, solubility of, 115.
 rate of evolution of, from super-saturated solutions, 173.
 Carbonyl ferrocyanides, 10.
 Catalytic activity of acids, 308.
 Caulophyllosaponin and caulophyllosapogenin, 2.
Caulophyllum thalictroides, constituents of the rhizome and roots of, 2.
 Caulosaponin and caulosapogenin, 2.
 Celluloid, absorption of gases by, 368.
 Cellulose, methylation of, 251.
 action of ozone on, 104, 222.
 nitrate, viscosity of solutions of, 244.
 peroxide, 222.
 Cephaeline, constitution of, 227.
 Cerebrone, isolation and purification of, 175.
 Certificates of candidates for election, 36, 137, 209, 312.
 Ceryl-*d*-glucoside, 171.
 Cetyl-. See Hexadecyl-.
 Charcoal, influence of, on the evolution of carbon dioxide from solutions, 173.
 Chaulmoogric acid, occurrence of, 197.
 Chemical constitution, dependence of rotatory power on, 266, 296.
 of ketones, relation between absorption spectra and, 354.
 and absorption spectra of nitro-aminophenols, 160.
 and residual affinity, relation between, 249.
 and colour, relation between, 6.
 relation between depth of colour of dyes and, 348.
 and colour of azomethines, 191.
 and viscosity, relation between, 378.
 reactivity and absorption spectra, 216.
 Chloral hydrate, condensation of carbamide and, 352.
 Chlorine, interaction of hydrogen and, 75.
 Hydrochloric acid, influence of water on the partial pressure of gaseous, above its alcoholic solutions, 5.
 equilibrium of gelatin and, 370.
 Cholesterol-*d*-glucoside, 171.
 Chrysarobin, constituents of commercial 285.
 Cinnamic acids, iodo-, 173.
 Cinnamylidene-*p*-toluidine, derivatives of, 114.
 Chaudet, A. C., reference to decease of, 1.
 Coal, composition of, 376.
 volatile constituents of, 250.
 distillation of, in a vacuum, 376.

- Coal-dusts, relative inflammabilities of, 250.
- Cobalt nitrate, extinction curves of solutions of, 4.
- Cocaine, absorption spectrum of, 180.
- Colloids, influence of, on the solubility of gases in water, 115.
- influence of, on the evolution of carbon dioxide from solutions, 173.
- Colour and constitution, relation between, 6.
- and chemical constitution of azo-methines, 191.
- Colouring matters, mechanism of formation of, 116.
- relation between chemical constitution and depth of colour in, 348.
- from quercetin, 349.
- Committees, appointment of, by Council, 121.
- Compressibility of liquids, 252.
- Conductivity water. See Water.
- Co-ordination and residual affinity, 371.
- Copper, action of sulphur dioxide on, 225.
- action of sulphuric acid on, 344.
- Cupric citrate and malate, 191.
- Cuprous iodide, crystallisation of, 62.
- Copper, detection of, 303.
- Cotarnine, condensation products of, 63.
- Coumarone derivatives, 257, 258.
- Coumaranonecarboxylic acid, acylazo-derivatives of, 258.
- ethyl ester, constitution of, 257.
- Council, announcement of proposed changes in officers and, 50.
- report of, 81.
- m*-Cresol, action of chlorine on, 63.
- Crossman, T., reference to decease of, 274.
- Cundall, J. T., reference to decease of, 343.
- Cyanamide, polymerisation of, 300.
- Cyanic acid, polymerisation of, 132.
- Cyano-gen, constitution of, 114.
- bromide, reactions of, 113.
- Cyaphenine, molecular weight of, 175.
- Cydinus Indicus*, constituents of the oil of, 28.
- Davidson, J., reference to decease of, 274.
- Deane, L. M., reference to decease of, 274.
- Dehydration by electrical heating in a vacuum, 233.
- Denitrification, mechanism of, 307.
- due to enzyme action, 117.
- Deoxybenzoin, synthesis of derivatives of, 172.
- Desiccator, vacuum, for electrical heating, 233.
- Desylamine, derivatives of, 228.
- Dextrose, viscosity of solutions of, 264.
- condensation of acetone and, 260.
- dimethylacetal- ϵ -monoacetone, 261.
- Dialkylacetamides, application of Hofmann's reaction to, 126.
- $\alpha\beta$ -Diallylaminopropionic acid, carbamido-derivatives of, 158.
- Dianhydrottrisdbenzylsilicanediol, 348.
- Diazo-compounds, aliphatic, constitution of, 150.
- o*-Diazoimines, constitution of, 232, 374.
- Diazonium salts, non-aromatic, 133, 247, 374.
- 3 : 5-Dibenzo- $\Delta^3:5$ -cycloheptadiene, 1-anino-, and its derivatives, 105.
- Dibenzocycloheptadienecarboxylic acid, hydrazide of, 105.
- 3 : 5-Dibenzo- $\Delta^3:5$ -cycloheptadien-1-one-2-carboxylic acid, ethyl ester and its copper salt, 106.
- Dibenzocycloheptadienylurethane, 105.
- 3 : 5-Dibenzo- $\Delta^{1:3:5}$ -cycloheptatriene and its picrate, 106.
- Dibenzylsilicanediol, condensation products of, 348.
- Dibenzylstannane, dihydroxy-, condensation products of, 280.
- Dicarboxyglutaconic acid, ethyl ester, action of amino-acid esters on, 353.
- Diethylacetobromoamide, 126.
- Diethylaminoglucose, 7.
- β -Diglycerylphosphoric acid, calcium salt, the so-called, 228.
- s*-Di- δ -heptylcarbamide, 126.
- Dihydroisindole, preparation of, 224.
- Dihydroresorcin, substituted, 286.
- 2 : 3-Dimethoxybenzoic acid, nitro-derivatives, 380.
- 2 : 3-Dimethoxytoluene, and 5- and 6-nitro-, 380.
- 5 : 6-Dimethoxy-*m*-toluidine, 2-nitro-, 380.
- Dimethoxyvalerolactone, 363.
- 3-Dimethylaminoacetyl-2-methylindole, 59.
- Dimethylaminoglucose, 7.
- 2- α -Dimethylamino- γ -hydroxypropylindole, 59.
- 2 : 6-Dimethyl-2 : 3-dihydro-1 : 4-pyran and its 5-carboxylic acid and its ethyl ester, 72.
- Dimethyldihydroresorcin, bromoxyleneols from, 369.
- 2 : 2'-Dimethyldiphenyl, formation of cyclic compounds from derivatives of, 105.
- 2 : 2'-Dimethyldiphenyl-5 : 5'-dicarboxylic acid and its nitrile and esters, 10.

- 2:2'-Dimethyldiphenyl- $\omega\omega'$ -dicarboxylic acid, ethyl ester, 106.
 $\beta\gamma$ -Dimethyl glucose, 261.
 and its derivatives, 71.
 $\alpha\gamma$ -Dimethylglutaconic acid, normal and labile forms of, 5.
cis- $\alpha\gamma$ -Dimethylglutaric acid, formation of, 5.
 1:2-Dimethyl- $\Delta^{2:6}$ -cyclohexadiene, 193.
 $\beta\gamma$ -Dimethyl methylglucoside and its $\epsilon\zeta$ -monoacetone derivative, 261.
 β -2:5-Dimethylpiperazine, identity of the supposed, 382.
 $\beta\beta$ -Dimethylpropanetricarboxylic acid, 255.
 3:5-Dimethylpyrazole, 4-amino-, dihydrochloride, 379.
 3:5-Dimethylpyrazole-4-diazonium salts, and their azo-derivatives, 379.
 2:3-Dimethyl-2:3:5:6-tetrahydro-1:4-pyran, 73.
 Dinaphthanthracene derivatives, synthesis of, 126.
 Dinaphthathioxin and its isomeride, 151.
 γ -Dinaphthylpentane, 1:1-dihydroxy-, 382.
 β -Dinaphthylpropane, 1:1-dihydroxy-, oxidation of anhydride of, 382.
 Dioxime peroxides, constitution of, 152.
 2:2'-Diphenol, azo-derivatives of, 248.
 Diphenyl series, studies in the, 77, 289.
 Diphenylcarbamyloximes, 248.
 2:3-Diphenyl-2:3-dihydro-1:3:4-naphthaisotriazine, optical resolution of, 259.
 s -Diphenyloctamethylenediamine, preparation of, 189.
 Diphenylcyclopentenone, condensation products of, 74.
 Diphenylsilicanediol, condensation products of, 374.
 Diphenyl-2:5:2':5'-tetracarboxylic acid, tetramethyl ester, 10.
 Dipropylacetobromamide, 126.
 $\alpha\beta$ -Dipropylaminopropionic acid, carbamido-derivatives of, 158.
 Dispersion, rotatory, measurement of, 171.
 anomalous, 185.
 of organic compounds, 171, 221, 348.
 Ditolyl. See Dimethyldiphenyl.
 $\alpha\beta$ -Di-*o*- and -*p*-tolylethanes, $\alpha\beta$ -dihydroxy-, 262.
 Di(β -trichloro- α -hydroxyethyl)carbamide, 352.
 Duleitol, melting point of, 128.
 Dyes. See Colouring matters.
 Election of fellows, 51, 168, 215, 344.
 Election of honorary and foreign members, 180.
 Electrical conductivity of solutions, determination of, 132.
 Emetine, constitution of, 227.
 Enantiomorphism of molecular and crystal structure, 62.
 Enzyme action, denitrification through, 117.
 Equilibrium of hydrochloric acid and gelatin, 370.
 Eseroline, constitution of, 59.
 Ethyl alcohol, densities of mixtures of ethyl acetate and, 259.
 azeotropic mixtures of ethyl acetate, water and, 259, 260.
 vapour pressure of, and of its azeotropic mixture with water, 68.
 the system: xylene, water, and, 383.
 Ethylaminoglucose, 7.
 Ethylcarbamide, β -trichloro- α -hydroxy-, 352.
 Ethylene glycol diacetate, hydrolysis of, 4.
 Ethylidenecarbamide, β -trichloro-, 353.
l-Epicamphor, 356.
l-Fenchyl alcohol, 127.
 Ferrocyanides, methylated, isomerism in the, 188.
 Findon, F. S., reference to decease of 121.
 Fluorescence, Baly-Krulla theory of, 201.
 Formic acid, mechanism of production of, from glycerol and oxalic acid, 383.
 sodium salt, reduction of mercuric chloride by, 250.
 Fluorone derivatives, 378.
 Furoxans. See *iso*Oxadiazole oxides.
 Gases, influence of colloids on the solubility of, in water, 115.
 rate of evolution of, from super-saturated solutions, 173.
 absorption of, by celluloid, 368.
 mixtures of, explosiveness of, 130.
 Gelatin, equilibrium of hydrochloric acid and, 370.
 Geranyl chloride and its nitrosate, 244.
 Geranylamine, 244.
 Glass, permeability of, to halogen vapours, 111.
 Gluconamide, 7.
d-Glucosamine, conversion of, into *d*-mannose, 306.
 Glucoses, partly methylated, 70, 71.

- Glutaconic acids, chemistry of the, 5, 253, 254, 255.
- Glycerol, interaction of oxalic acid and, 383.
- Glyceryl trinitrate, partial pressure of, in solution in acetone, 157.
- Glycylmethylenemalononic acid, ethyl ester, 353.
- Glyoxal, action of magnesium aryl haloids on, 262.
- Gossypetin and its ethers, 110.
- Gossypitol, ethers of, 110.
- Gossypitone, 110.
- Guaiacum resin as a reagent for the detection of oxydases and of copper, 303.
- Guanidine thiocyanate, formation of, 189.
- Guanidinium nitrite and its decomposition by heat, 283.
- Harmaline, 290.
- isoHarman, synthesis of, 290.
- Harmine, 290.
- Hartley, Sir W. N., reference to decease of, 274.
- Helium, presence of, in the gas from an X-ray bulb, 21.
- Heptane, $\beta\zeta$ -dibromo-, 73.
- cycloHeptanecarboxylic acid in the oil of *Cydnus Indicus*, 28.
- Heptane- $\beta\zeta$ -diol and -dione, 73.
- Heptan- ζ -ol- β -one, 73.
- Heptan- β -one, ζ -bromo-, 73.
- Heron, J., reference to decease of, 103.
- Hexadecyl-*d*-glucoside, 171.
- Hexahydropyrimidine and its dibenzoyl derivative, 29.
- cycloHexanones, condensation of, with cyanoacetamide, 256.
- cycloHexanone-4-carboxylic acid, optically active salts of the semicarbazone and benzoylphenylhydrazone of, 309.
- Δ^5 -cycloHexenone, 2 : 2 : 3 : 4 : 4 : 6-hexachloro-5-iodo-, 283.
- Homoveratroyl- β -phenylethylamine, 2-nitro-, 131.
- Hops, constituents of, 180.
- nitrogenous constituents of, 182.
- Humulol, 181.
- Hunter, J., reference to decease of, 149.
- 2-Hydrazinohydrindene, 1-hydroxy-, and its derivatives and optical resolution, 109.
- β -Hydrindone, condensation products of, 74.
- Hydroaromatic compounds, aromatic compounds from, 369.
- Hydrocarbon, $C_{10}H_{18}$, from geraniol and thionyl chloride, 244.
- Hydrocarbon, $C_{10}H_{18}$, from reduction of geranyl chloride, 244.
- Hydrogen, presence of neon in, after treatment with the electric discharge, 22, 79, 217, 233.
- interaction, of chlorine and, 75.
- Hydrogen peroxide, catalytic decomposition of, 55, 56.
- action of, on sodium alkyl thio-sulphates, 356.
- α -Hydroxy-acids, relation of α -amino-acids to, 192.
- conversion of α -ketonic aldehydes into, 156.
- Hydroxyl ions, determination of the concentration of, 249.
- Hyoscine, absorption spectrum of, 180.
- Hyoscyamine, absorption spectrum of, 180.
- Imides, aromatic, formation of cyclic bases from, 224.
- Imino-compounds, formation and reactions of, 256.
- Indoles, substituted, formation of, 287.
- International association of chemical societies, report of, 325.
- Iodine, interaction of thiocarbamide and, 14.
- blue adsorption compounds of, 128.
- Iodo-compounds, rate of interaction of sodium phenoxide and, 159, 246, 305, 379.
- Ionic reactions, influence of acetyl-acetone on, 30.
- Ionisation and the law of mass action, 3, 371.
- Ipecacuanha, alkaloids of, 226.
- Ipiranol, identification of, as a phyto-sterol glucoside, 63.
- Iron, porosity of, 302.
- colour intensity of, 192.
- Ferric salts, reaction between thiocyanates and, 123.
- reaction between thiosulphates and, 30.
- Iron, cyanogen compounds, blue, 32.
- green, 54.
- Ferric organic salts, 191.
- Isomeric change, influence of light on, 168.
- Isomerism, dynamic, studies of, 168.
- Johnson, O. C., reference to decease of, 49.
- Kaempferin, 278.
- 7 - Keto - 4-dimethylaminophenyl-2-*m-p*-dihydroxyphenyl - 1 : 4 - benzopyran, 3 : 5-dihydroxy-, 349.

- β -Keto- α -(and - β)-4-methoxyphenyl- β -(and α)-3:4-dimethoxyphenylethanes and their oxime, 172.
 Ketones, relation between absorption spectra and constitution of, 354.
 α bromination in, 289.
 condensation of phenols and, 29.
 aliphatic, absorption spectra of, 130.
 cyclic, studies on, 74.
 unsaturated, absorption spectra of, 26.
 Lactic acid, rotation of derivatives of, 284.
 Lactones formed by the fission of the *gem*-dimethylcyclopropane ring, structure of, 259.
 Ladenburg memorial lecture, 273.
 Laevulose, viscosity of solutions of, 264.
 Lead, potassium carbonate, 185.
 cyanide, 361.
 estimation of, 173.
 Leontin, 3.
 Lewkowsch, J., reference to decease of, 274.
 Lichtenstein, T. D., reference to decease of, 49.
 Liquids, intermiscibility of, 362.
 compressibilities of, 252.
 mixed, molecular condition of, 194.
 surface tension of, 359, 360.
 optically active, optical and magnetic rotatory dispersions in, 348.
 Lithium, chloride and iodide, solubilities of, in alcohols, 263.
 acetylacetone, 373.
 McArthur, J., reference to decease of, 1.
 Magnesium salts, behaviour of, with soap solutions, 76.
 aryl haloids, action of, on glyoxal, 262.
 Magnetic rotation, measurement of, 221.
 of organic liquids, 221.
 Malic anhydride, 262.
 Malonic acid, ethyl ester, condensation of, with acid chlorides, 261.
 sodium derivative, action of $\alpha\gamma$ -dibromobutane on, 74.
 so-called disodium derivative, 11.
 Manganomanganic ferrocyanide, 32.
 Manna, new variety of, 128.
d-Mannose, conversion of *d*-glucosamine into, 306.
 Marshall, H., reference to decease of, 274.
 Mass action, law of, and ionisation, 3, 371.
 Matthey, G., reference to decease of, 49.
 Meconine, α -cyano-, 267.
*iso*Melamine, and its salts, 377.
 Mellitic acid, derivatives of, 106.
 Mellitic anhydride, 106.
 Memorial lecture, Ladenburg, 273.
 Van't Hoff, 179.
 Mercury alloys with silver and tin, 282.
 with sodium, interaction of water and, 298.
 action of variously treated waters on, 299.
 Mercuric chloride, reduction of, 250.
 Mercury, estimation of, 77.
 Mesityl oxide, semicarbazones, of, 59.
 Metallic acetylacetones and their absorption spectra, 371, 373.
 haloids, change of colour of solutions of, 225.
 Methane, preparation and analysis of, 130.
 Methane, *tetranitro*-, colours produced by, with certain compounds, 161.
 interaction of compounds containing centres of residual affinity and, 304.
 Methoxymethylfisetol dimethyl ether, 253.
p-Methoxyphenylacetyl chloride, 172.
 4-Methoxyphthalic acid, nitro-derivatives, 380.
 4-Methoxy-*o*-xylene, 5-nitro-, 381.
 1-Methylcyclobutane-2-carboxylic acid, 74.
 1-Methylcyclobutane-2 : 2-dicarboxylic acid and its ethyl ester, 74.
 Methylcarbinols, esters of, 296.
 3 - Methyl - 6 - β - chloro*isopropyl*hexadienone, 2:4:4:5-*tetrachloro*-, 69.
 Methylenebisine and its picrate, 2.
N-Methyldihydroisindole, 224.
 Methyldihydroresorcinols, 1- and 2-, 286.
 Methyl- $\alpha\alpha$ -dinaphthylmethane, 1:1-dihydroxy-, anhydride of, and its derivatives, 29.
 ζ -Methyl glucose and its derivatives, 70.
 Methylglucoside- $\epsilon\zeta$ -monoacetone, 261.
 3-Methylhexadienone, 2:4:4:5:6-*penta-chloro*-, 69.
 3- and 4-Methylcyclohexane-1:1-diacetic acids, 256.
 Methyl ketones, action of nitrogen iodide on, 284.
 β -Methylmuconic acid and its methyl and ethyl esters, 14.
 Methyl- α - and - β -naphthacoumarincarboxylic acids, 154.
 Methyl pentoses, constitution of, 363.
N-Methylphthalimidine, electrolytic reduction of, 224.
 β -Methylpropene- $\alpha\gamma\gamma'$ -tricarboxylic acid, 255.
 1-Methyl-2-*isopropenyl*- Δ^1 -cyclopentene, 193.

- 3-Methyl-6-isopropylhexadienone, 2:4:4-trichloro-, 68.
- Methylquercetin, tetra- and penta-methyl ethers, 252.
- Methylsilicosis, 190.
- Methyltetronic acid, brucine salt, 363.
- i*-Methyl tetritol, synthesis of, and its derivatives, 363.
- i*-Methyl tetrose, synthesis of, and its derivatives, 108, 363.
- Methylthiobenzanilide *N*- and *S*-, 360.
- Micro-furnace, electric, 134.
- Minerals, fractionation of, 134.
- Miscibility of solids, 262.
- Mixtures, surface tension of, 359, 360.
binary, vapour pressures of, 157.
thermal properties of, 262.
- Molecular refraction of acenaphthene and its monohalogen derivatives, 224.
- apo*Morphine, experiments on the synthesis of, 131.
- Muconic acid, and its methyl and ethyl esters, 14.
- Myricyl-*d*-glucoside, 171.
- Naphthalene, 1-chloro-2 : 4 : 5- and 2 : 4 : 8-*trinitro*-, 293.
- β -Naphthol, constitution of, 197.
sulphides of, 197.
action of bromine on, 53.
- α -Naphthylamine, 2 : 4 : 5-*trinitro*-, 264.
- Naphthylamines, alkyl derivatives, preparation of, 189.
- α -Naphthyl methyl ether, 2 : 4 : 5-*trinitro*-, 264.
- Neon, presence of, in hydrogen after treatment with the electric discharge, 22, 79, 217, 233.
- Nicotine, absorption spectrum of, 180.
- o*-Nitroamines, conversion of, into *iso*-oxadiazole oxides, 275.
- Nitro-compounds, coloured liquid mixtures of amines and, 278.
- Nitrogen iodide, action of, on methyl ketones, 234.
*d*ioxide, action of, on potassium permanganate, 235.
- Nitrous acid, interaction of thiocarbamide and, 188.
- Nitrites, estimation of, 188.
- Hyponitrous acid, conductivity of, 185.
- Nitrogen atom, doubly linked, configuration of the, 309.
- Nomenclature of the rhamnose group, 54.
of sugar derivatives, 69.
- Oleanol, derivatives of, 301.
- Oleanone and its acetyl derivatives, 301.
- Oncoba echinata*, fat of the seeds of, 197.
- Optical activity and enantiomorphism of molecular and crystal structure, 62.
- Optically active compounds, influence of solvents on the rotation of, 234.
- Organic compounds, rotatory dispersive power of, 171, 221, 348.
- Osmotic data in relation to combined water, 371.
- iso*Oxadiazole oxides (*furoxans*), constitution of, 152.
conversion of *o*-nitroamines into, 275.
- Oxalic acid, interaction of glycerol and, 383.
- Oximes, isomerism of the, 248.
- Oxonium salt, attempt to resolve an, 159.
- Oxydases, detection of, 303.
- Oxymethylenecamphor, *d*- and *l*-, derivatives of, 78.
- Ozone, action of, on beech-wood, 104.
action of, on cellulose, 222.
- Palmityl chloride, α -bromo-, 345.
- Palmitylglycine, α -amino- and α -bromo-, 345.
- Patchett, I., reference to decease of, 274.
- n*-Pentane, latent heat of, 24.
- Perezol and its acetyl derivative, 72.
- Perezone, derivatives of, 72.
- Phenanthraquinone, derivatives of, 268.
- Phenol, bacterial oxidation of, 156.
derivatives of, absorption spectra of, 253.
- Phenol, *p*-iodo-, chlorination of *o*-haloid derivatives of, 8.
trinitro-. See Picric acid.
- Phenols, condensation of acetonedicarboxylic acid with, 154.
condensation of camphorquinone with, 155.
condensation of ketones and, 29.
nitro-, structure of the salts of, 251.
nitroamino-absorption spectra of, 160.
trinitro-p-amino-, constitution of the, 248.
- Phenolphthalein, constitution of and its alkali salts, 270.
- Phenoxide, sodium, relative activities of iodo-compounds with, 159, 246, 305, 379.
- Phenyl mercaptan and sulphide, absorption spectra of, 194.
- Phenylacetyl- β -phenylethylamine, *o*-nitro-, 131.
- 2-Phenyl-1 : 4-benzopyran, 3 : 4 : 5 : 7-*m-p*-hexahydroxy-, 349.
- Phenyldi-imine, Vaubel's supposed, 24.

- 1-Phenyl-2:3-dimethylpyrazolone-4-diazonium chloride, azo-compounds from, 133.
- p*-Phenylenediamine, influence of substitution on the reactivity of, 229.
- p*-Phenylenediamine, 2:6-dichloro- and 2-nitro- and their acyl derivatives, 229.
- 2-Phenyl-4-ethyl-1:4-benzopyran anhydrohydriodide, 3:5:7-*m-p*-penta-hydroxy-, 349.
- β -Phenylglutaconic acid, 253.
- α -Phenylhexane- α -diol and -dione, 73.
- α -Phenylhexan- ϵ -ol- α -one, 73.
- α -Phenylhexan- α -one, ϵ -bromo-, 73.
- Phenylmethylcarbinols, optically active, interconversion of the, 109.
- 6-Phenyl-2-methyl-2:3-dihydro-1:4-pyran and its 5-carboxylic acid and its ethyl ester, 73.
- Phenylmethylethylazonium iodide, optical resolution of, 109.
- β -Phenyl- α -methylglutaconic acids, 253.
- 2-Phenyl-6-methyl-4-pyrone *d*- α -bromocamphor- π -sulphonate, resolution of, 159.
- Phenyl styryl ketone, action of heat on the semicarbazones of, and preparation of the phenylsemicarbazones of, 245.
- 2-Phenyl-5-styryloxazole, 261.
- Phorone, derivatives of, 302.
- Phosphonium iodide, action of heat on, 61.
- Phosphoric acids, 61.
- Phthalic acid, 3:4- and 3:5-dinitro-, and their derivatives, 61.
- Phthalimidine, electrolytic reduction of, 224.
- Physostigmine, constitution of, 59, 287.
- Phytic acid, 27.
- Phytin, 27.
- Phytosterolins, 64, 171.
- Picric acid, absorption spectrum of, 216.
- Piperazine, absorption spectra of derivatives of, 303.
- Piperidine, absorption spectrum of, 180. absorption spectra of derivatives of, 303.
- Polypeptides, synthesis of, 345.
- Potassium bromide, chloride, and iodide, spontaneous crystallisation of solutions of, 160.
- solubilities of, in alcohols, 263.
- carbonate, double carbonates of the alkaline earth metals and lead with, 185.
- oxalates, 252.
- permanganate, action of nitric oxide on, 235.
- Proline, identification of, 118, 177.
- Propionic acid, α -bromo-, action of sodium hydroxide and methoxide on, 129.
- Propionic anhydride, rate of hydration of, 265.
- Protein hydrolysis, tryptic, measurement of, 14.
- iso*Pulegol, 127.
- Purpurogallin, 354.
- Pye, T. E., reference to decease of, 343.
- Pyridine, absorption spectra of derivatives of, 303.
- Pyrone derivatives, absorption of iodine by, 128.
- Pyruvic acid, condensation of aldehydes with, 174.
- Quercetagenin and its ethers, and acetyl derivative, 9.
- Quercetageninic acid, 9.
- Quercetagenol tetraethyl ether, 9.
- Quercetin, methylation of, 253.
- dyes derived from, 349.
- Quercetin, 6'-amino-, 280.
- Quinol, compounds of, with sulphites, and their fluorescence, 4.
- Quinol-benzoin, hydroxy-, and its tetra-acetyl derivative, 10.
- Quinol-phthalein anhydride, hydroxy-, and its tetra-acetyl derivative, 9.
- iso*Quinoline alkaloids, synthesis in the group of, 63.
- Quinone-ammonium derivatives, 6.
- p*-Quinones, action of semicarbazide hydrochloride on, 226.
- Racemic compounds, existence of, in the liquid state, 67.
- Radioactive disintegration products, chemical nature of, 7, 172.
- Rao, B. V., reference to decease of, 49.
- Resorcinol-benzoin, 378.
- Rhamnose group, nomenclature of the, 54.
- Richardson, A., reference to decease of, 1.
- Ring compounds, new series of, 346.
- Roscoe, Sir H. E., presentation of bust of, to the Society, 296.
- Rotation, influence of solvents on the, of optically active compounds, 284.
- Rotatory dispersion. See Dispersion, rotatory.
- Rotatory power, dependence of, on chemical constitution, 266, 296.
- of derivatives of succinic acid, 352.
- Rotatory powers, co-ordination of, for different wave-lengths, temperatures, and solutions, 296.
- Roy, M. G., reference to decease of, 274.
- Rubidium chloride, solubility of, in alcohols, 263.
- Rubremetino hydrochloride, 227.

- Salts, quinonoid, of nitroanilines, 66.
 Sandberg, C. P., reference to decease of, 367.
 Sarsaparilla root, chemical examination of, 372.
 Sarsapic acid and its dimethyl ester, 372.
 Scandium acetylacetone, 373.
 Schiff's bases, addition of negative radicles to, 196.
 Selenium organic compounds, 196.
 Selenodiphenylamine, 196.
 Semicarbazones, 59, 245.
 Senna leaves, constituents of, 278.
 Seward, H., reference to decease of, 1.
 Silicon compounds, nomenclature of, 190.
 organic, 190, 348, 374.
 Silicoses, 190.
 Silver alloys with mercury and tin, 282.
 bromide, crystallisation of, 62.
 iodide, crystallisation of, 62.
 Sitosterol-*d*-glucoside, 171.
 Smilacin, composition of, 373.
 Soap, behaviour of calcium and magnesium salts with solutions of, 76.
 Sodium alloy with mercury (*sodium amalgam*), interaction of water and, 298.
 action of variously treated waters on, 299.
 chloride and iodide, solubilities of, in alcohols, 263.
 iodide with acetone of crystallisation, 117.
 hyponitrite, conductivity of, 185.
 hydrosulphide, conversion of, into the monosulphide, 154.
 polysulphides, 380.
 alkyl thiosulphates, action of hydrogen peroxide on, 356.
 Solids, miscibility of, 262.
 Solubility as a constitutive property, 119.
 Solutions, theory of, 362.
 determination of the electrical conductivity of, 132.
 supersaturated, rate of evolution of gases from, 173.
 Solvents, influence of, on the rotation of optically active compounds, 284.
 Spectra, absorption, and chemical reactivity, 216.
 of metallic acetylacetones, 371.
 of acids and their salts, relation between, 63.
 of unsaturated aldehydes and ketones, 26.
 of certain alkaloids, relation between constitution and, 180.
 of derivatives of aniline, phenol, and benzaldehyde, 253.
 Spectra, absorption, of azo-derivative from antipyrinediazonium salts, 247.
 of benzene derivatives, 132.
 of the two isomeric *o*-dinitrobenzidines, 77.
 and constitution of ketones, relation between, 354.
 of aliphatic ketones, 130.
 and chemical constitution of nitroaminophenols, 160.
 of derivatives of pyridine, piperidine, and piperazine, 303.
 of substances containing labile hydrogen atoms, 58.
 of sulphurous acid and sulphites, 375.
 of thio-derivatives of benzene, 194.
 Spencer, W. S., reference to decease of, 179.
 Sphingosin, oxidation of, 154.
 Strontium potassium carbonate, 187.
 Styryl benzoylaminomethyl ketone, 261.
 Substance, $C_{11}H_{20}O_2$, from the oil of *Cydacus Indicus*, 28.
 $C_{21}H_{40}O_3$, from the anhydride of β -1:1-dihydroxydinaphthylpropane, 382.
 $C_{24}H_{40}O_4$, from the anhydride of β -1:1:1-dihydroxydinaphthylpropane, 382.
 $C_{24}H_{38}O_3$, from reduction of $C_{24}H_{40}O_4$, 382.
 $C_{29}H_{42}O_4$, from oleone, 301.
 $C_{29}H_{38}O_3$, from oleone, 301.
 Succinic acid, optical rotatory power of derivatives of, 352.
 bromo-, action of sodium hydroxide and methoxide on, 129.
 Sucrose, viscosity of solutions of, 264.
 rate of inversion of, 281.
 Sugars, nomenclature of, 69.
 reducing, action of ammonia and alkylamines on, 7.
 Sulphanilic acid. See Aniline-*p*-sulphonic acid.
cis - Sulphonyldiacetatodiethylenediaminecobaltic hydrogen sulphonyldiacetate, 272.
 Sulphur chloride, action of, on metallic salts of organic acids, 261.
 Thionyl chloride, action of, on metallic salts of organic acids, 261.
 Polysulphides of the alkali metals, 380.
 Sulphuric acid, action of, on copper, 344.
 Sulphurous acid, and its salts, absorption spectra of, 375.
 Thiosulphates, reaction between ferric salts and, 30.

- Surface tension of mixtures, 359, 360.
 Sylvestrene, *d*-, constitution of, 223.
d- and *l*-, synthesis of, 356.
- Tartaric acid, action of, on tin, 122.
 ethyl ester, rotatory power of, 185.
- Tate, W., reference to decease of, 65.
- Tautomerism, keto-enolic, 130.
- Terpenes, chemistry of the, 246.
- Tetrahydroberberine alkyl hydroxides,
 constitution of the anhydro-bases
 derived from, 125.
- Tetrahydroquinadimethylenecam-
 phors, the ten stereoisomeric, 247.
- Tetramethyl ferrocyanide, isomeric forms
 of, 188.
- 2:2:3:3 - Tetramethylbicyclo[0,1,2]pen-
 tan-1-ol-5-one, 4-bromo-, 302.
- 1:1:2:2-Tetramethylcyclopentan-4-one,
 302.
- Thallous nitrite, 197.
- Thioanilides, tautomerism of, 360.
- Thiocarbamide, interaction of iodine and,
 14.
 interaction of nitrous acid and, 188.
- Thiocyanates, reaction between ferric
 salts and, 123.
- Thorium, relation of uranous salts to,
 383.
- Thymol, action of chlorine on, 68.
- Tin, action of tartaric acid on, 122.
 alloys with mercury and silver, 282.
 organic compounds, 280.
- o*-Toluic acid, 3:4- and 3:5-dinitro-, 61.
- α -*p*-Toluidino- γ -phenylisocrotonitrile,
 115.
- o*-Tolyl methyl ether, 5:6-dinitro-
 3-hydroxy-, 380.
- p*-Tolylacrylic acid, 3-nitro-, reduction
 of, 287.
- 3:4-Tolylenediamine, 3-acetyl and 3-
 benzoyl derivatives, 232.
- 3:4-Tolylenediazomide, constitution of
 α - and β -acetyl derivatives, 232.
- β -*p*-Tolylpropionic acid, 3-amino-, 287.
- Triahydrotetraakisdiphenylsilicane diol,
 375.
- 4-Triazo-3:5-dimethylpyrazole, 379.
- Triethoxybenzeneglyoxylic acid, hydr-
 oxy-, 110.
- 3:5:7-Triethoxy-2-*m*-*p*-diethoxy-
 phenyl-4-ethyl-1:4-benzopyran an-
 hydrohydriodide, 349.
- γ 5 ϵ -Trimethyl glucose, 71.
- Tri- α -naphthylbismuthine, 77.
- 2:4:5-Triphenyloxazole, preparation
 of, 229.
- Uranous salts, relation of, to thorium,
 383.
 chloride, absorption of light by, 284.
- Vanadyl acetyl mesityl oxide, 374.
- Van't Hoff Committee, report of the,
 167.
- Vapour pressure of alcohols and of their
 azeotropic mixtures with water, 68.
- Vapours, latent heat of, 24.
- Velocity of formation of quaternary
 ammonium salts, 32.
- Velocity of hydration of acid anhydrides,
 265.
- Velocity of reaction, measurement of,
 280.
 of alkyl iodides with sodium phen-
 oxide, 159, 246, 305, 379.
- Viscometer, a constant pressure, 172.
- Viscosity and association, 32.
 relation between chemical constitution
 and, 378.
 criticism of investigations on, 113.
 determination of, 361.
 maxima and their interpretation, 174.
- Walden inversion, experiments on the,
 109.
 model to illustrate the, 198.
- Wallace, A., reference to decease of,
 274.
- WATER :
 Conductivity water, preparation of,
 124.
 determination of hardness in, 76.
- Weights, molecular, apparatus for the
 determination of, 349.
- Xanthohumol, 181.
- Xanthoxylum brachyacanthum*, alkal-
 oids of, 26.
- o*-Xylene, derivatives of, 26, 126, 169,
 170, 217, 352.
 nitro-derivatives oxidation of, 60.
 3:4:5- and 3:4:6-trinitro-, mobile
 nitro-groups in, 169.
- m*-Xylene, the system: alcohol, water,
 and, 383.
- o*-Xylene-5-sulphonic acid, 4-nitro-, 26.
- o*-3-Xylenol, 5-bromo-, and its benzoyl
 and *o*-nitrobenzoyl derivatives, 352,
 369.
- 4:5-dibromo-, and its acetyl and
 benzoyl derivatives, 170, 369.
- o*-4-Xylenol, 5- and 6-bromo- and their
 benzoyl and *o*-nitrobenzoyl deriv-
 atives, 217, 369.
- Xylinel sulphonic acids, 126.
- 2:4-Xylylsuccinamic acid, 287.
- Zinc, rate of volatilisation of, 151.
 acetylacetone, 373
 estimation of, 153.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29

No. 409.

Thursday, January 23rd, 1913, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Messrs. James W. McBain, M. Nierenstein, Arthur J. Hale, and W. Compton Till were formally admitted Fellows of the Society.

The PRESIDENT referred to the loss sustained by the Society, through death, of:

	<i>Elected.</i>	<i>Died.</i>
Arthur Crozier Claudet ...	June 18th, 1902	January 17th, 1913
John McArthur	December 1st, 1887	December 9th, 1912
Arthur Richardson	June 18th, 1885	June 1st, 1912
Henry Seward	January 20th, 1870	April 12th, 1912

Certificates were read for the first time in favour of Messrs.:

William Beath, 152, St. George's Road, Hull.

Percy Charles Burr, B.Sc., Essex Lodge, Ravensbourne Park, Catford, S.E.

Harold Reginald Septimus Clotworthy, B.A., B.Sc., 39, Trinity College, Dublin.

John Albert Cockshutt, M.Sc., Queen's College, Taunton.

Tin Kari Ghose, B.A., 23/1, Baniatola Street, Hatkhola P.O., Calcutta.

George Watson Gray, 8, Inner Temple, Liverpool.

Daniel William Lloyd, B.Sc., The Manse, Ormonde Road, Kilkenny.

Walter Cyril Loynes, Eastfield, Comberton Road, Kidderminster.
Alexander Killen Macbeth, M.A., B.Sc., 3, Victoria Terrace, Cregagh, Belfast.

Henry Stephen Martin, 64, Dyke Road, Brighton.

Aylmer Henry Maude, Great Baddow, Chelmsford.

Joseph Horsnell May, 21, Donovan Avenue, Muswell Hill, N.

Ernest Joseph Mumford, 67, Hatherley Road, Walthamstow, N.E.

John Walter Smith, B.Sc., 48A, Hurstbourne Road, Forest Hill, S.E.

Hubert Rogers Wood, c/o Messrs. Fenner, Alder and Co., Ltd., Millwall, E.

A Certificate has been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Mr. Jonathan Parker, c/o The Wattle Extract Co., 42, Anglo-African House, Durban, Natal.

Of the following papers, those marked * were read :

- *1. "The constituents of the rhizome and roots of *Caulophyllum thalictroides*." By Frederick Be ding Power and Arthur Henry Salway.

The material employed for this investigation consisted of the rhizome and roots of the American plant, *Caulophyllum thalictroides* (Linné), Michaux (Nat. Ord. *Berberidaceae*).

A preliminary test showed the presence of an alkaloid, and a small amount of an enzyme was obtained, which slowly hydrolysed amygdalin.

An alcoholic extract of the ground material, when distilled in a current of steam, yielded a small amount of an essential oil. From the alcoholic extract the following definite compounds were isolated: (i) Methyleytisine, $C_{12}H_{10}ON_2$ (m. p. 137° ; $[\alpha]_D - 221.6^\circ$), the *picrate* of which melts at 228° ; (ii) a crystalline glucoside, *caulosaponin*, $C_{54}H_{88}O_{17} \cdot 4H_2O$ (m. p. $250-255^\circ$), which on hydrolysis is resolved into *caulosapogenin*, $C_{42}H_{66}O_6$ (m. p. 315°), and dextrose; (iii) a new crystalline glucoside, *caulophyllosaponin*, $C_{66}H_{104}O_{17}$ (m. p. $250-260^\circ$; $[\alpha]_D + 32.3^\circ$), which on hydrolysis is resolved into *caulophyllosapogenin*, $C_{56}H_{88}O_6$ (m. p. 315°), and arabinose; (iv) a phytosterol, $C_{27}H_{46}O$ (m. p. 153°); (v) citrullol, $C_{24}H_{45}O_2(OH)_3$; (vi) a mixture of fatty acids, consisting of palmitic, stearic, cerotic, oleic, and linolic acids. The alcoholic extract also

contained a quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 210°), and a comparatively small amount of resinous material.

Methylcytisine represents the alkaloid first isolated by J. U. Lloyd (*Proc. Amer. Pharm. Assoc.*, 1893, **41**, 115), and designated by him "caulophylline," but its composition had not heretofore been known. The glucoside to which the name of *caulosaponin* has now been given is undoubtedly identical with a glucosidic substance, which was likewise first obtained by Lloyd, and termed "leontin," although its formula had not been correctly determined. Its complete characterisation has now been effected.

*2. "Ionisation and the law of mass action."

By William Robert Bousfield.

The author showed that the dilution laws for strong electrolytes formulated by Rudolphi, van't Hoff, and Kohlrausch (with some others) are all true in the region of very high dilution, all being equivalent in that region to the simple law:

$$(1 - \alpha) = h^{-1} \times \text{Constant},$$

where *h* is the total number of molecules of water per mol. of solute. In this region the law for weak electrolytes becomes:

$$(1 - \alpha) = h^{-1} \times \text{Constant}.$$

The fundamental difference between weak and strong electrolytes may therefore be thus stated:

For weak electrolytes, at great dilution, the active mass of the undissociated fraction is inversely proportional to the mass of the water.

For strong electrolytes, at great dilution, the active mass of the undissociated fraction is inversely proportional to the square root of the mass of the water.

The question of the best method of arriving at the true coefficient of ionisation was also considered.

DISCUSSION.

In reply to Dr. Senter, Mr. BOUSFIELD stated that he thought it was by a special consideration of the active mass of the dissociated fraction of the solute that the formulæ would be ultimately brought into conformity with the law of mass action. As to the manner in which the theory of ionic sizes reconciled the series of values for freezing-point depressions, he referred to a former paper (*Phil. Trans.*, 1906, A, **206**, 149).

- *3. "The character and cause of the blue fluorescence which develops in alkaline solutions containing quinol and sulphite on exposure to the air." By Thomas Cunningham Porter.

Moist *p*-benzoquinone and quinhydrone each react directly with neutral as well as with acid alkali-metal sulphites to form compounds which differ according to which of the reagents is in excess.

With excess of sulphite remarkably stable compounds such as $(\text{NH}_4\text{HSO}_3)_2\text{C}_6\text{H}_4\text{O}_2$ are produced. These, in turn, form with alkali- and alkaline-earth-metal hydroxides substances which give brilliantly fluorescent aqueous solutions.

The character of this blue fluorescence was described, and it was shown that the fluorescence of "stale" quinol and sulphite photographic developers is identical with it, and due to the same cause.

- *4. "The form of extinction curves: cobalt nitrate solutions." By Thomas Ralph Merton.

An investigation has been made of the extinction curves of cobalt nitrate solutions, which exhibit a single absorption band in the visible spectrum. It has been found that the curve may be represented within the limits of experimental error by a simple mathematical expression. It is suggested that many of the apparently anomalous forms of extinction curves which are found are due to the superposition of some such simple type as the above.

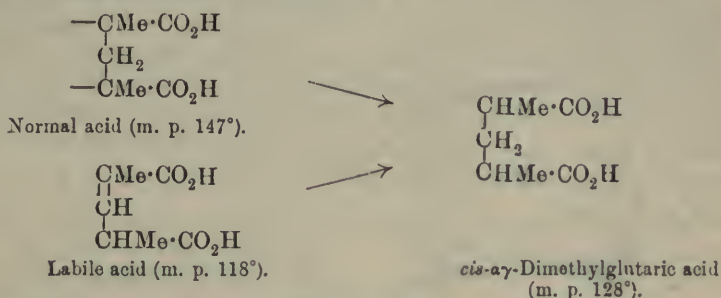
5. "The hydrolysis of ethylene glycol diacetate. (Preliminary note.)" By Ernest Graham Bainbridge.

The author has investigated the action of sodium ethoxide in alcoholic solution on ethylene glycol diacetate at the boiling point of the mixture, and finds that ethyl acetate is produced. A yield of 85 per cent. of ethylene glycol can readily be obtained as follows: A molecular mixture of ethylene glycol diacetate and sodium ethoxide is heated on a steam-bath to remove the ethyl acetate and excess of alcohol, the residue treated with water, and distilled under diminished pressure. The distillate is then fractionated, the yield being almost that required by theory.

The author is at present engaged in working out the mechanism of the reaction, and in further investigating the action of sodium ethoxide and sodium hydroxide on ethylene glycol diacetate.

6. "The chemistry of the glutaconic acids. Part VII. The normal and labile forms of $\alpha\gamma$ -dimethylglutaconic acid and their reduction to *cis*- $\alpha\gamma$ -dimethylglutaric acid." By Jocelyn Field Thorpe and Arthur Samuel Wood.

It has been found possible to isolate the labile modification of $\alpha\gamma$ -dimethylglutaconic acid, which is a crystalline substance melting at 118° . The view expressed in previous parts of this series that both the labile and normal forms of substituted glutaconic acids have a *cis*-configuration is supported by the fact that both the labile and normal forms of $\alpha\gamma$ -dimethylglutaconic acid yield *cis*- $\alpha\gamma$ -dimethylglutaric acid on reduction:



The properties of the labile acid were described.

7. "The influence of water on the partial pressure of hydrogen chloride above its alcoholic solutions." By William Jacob Jones, Arthur Lapworth, and Herbert Muschamp Lingford.

The authors have determined the partial pressures of hydrogen chloride above its anhydrous alcoholic solution over a range from $0.275N$ to $3.19N$, and also in presence of small quantities of water up to 2.5 gram-molecules per litre. The apparatus used consisted of three saturators of the type devised by Gahl, united by ground-glass joints with mercury seals, and containing in order, anhydrous ethyl alcohol, the hydrogen chloride solution, and water respectively. Hydrogen was passed through the apparatus, which was wholly immersed in a thermostat at $25^\circ \pm 0.05$, the use of air having been found to lead to chemical change and inconsistent results; the volume of gas used was determined from the weight of alcohol which passed from the first saturator, whilst the hydrogen chloride expelled from the second solution (which remained practically constant in concentration) was ascertained by titration of the liquid in the third saturator.

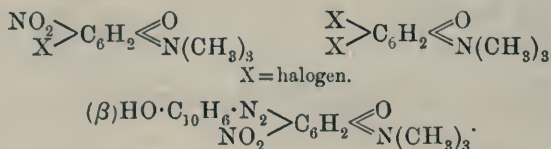
The results obtained were consistent, and the method appeared

to give satisfactory values, except possibly with very low pressures (0.2 mm. or less), when water was present.

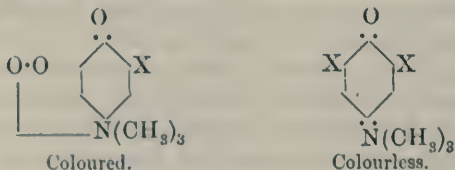
A somewhat complicated formula, based on Dolezalek's expression, serves to express the influence of the concentration of hydrogen chloride or water, or both together, over a wide range.

8. "Quinone-ammonium derivatives. Part II. Nitro-haloid, dihaloid, and azo-derivatives." By Raphael Meldola and William Francis Hollely.

In continuation of their former paper (T., 1912, 101, 912) the authors described new types of quinone-ammonium derivatives containing halogens and azo-groups. The isolation of these compounds had been made possible by the discovery that the nitro-groups in the dinitrotrimethylammonium-benzoquinone described in their last communication could be either partly or completely reduced, the resulting amino- and diamino-compounds being amenable to treatment by all the ordinary diazo-methods. The compounds described were of the types:



The preparation of the bisazo-compound from β -naphthol and the isolation of the first of the quinone-ammonium derivatives containing an asymmetric nitrogen atom was preliminarily indicated by the authors. The relationship between the colour and constitution of the compounds was further considered, and preference provisionally given to the "aci"-form for the nitro-group in the nitro-derivatives which are invariably coloured, the corresponding haloid derivatives being colourless:



The "quinole" structure for the hydrated form (T., 1912, 101, 918) was considered to have received further support from the experimental results obtained.

9. "The chemical nature of some radioactive disintegration products." By Alexander Fleck.

It has been found that uranium-*X*, mesothorium-2, radioactinium, thorium-*B* and *C*, actinium-*B* and *C*, radium-*B*, *C*, and *E*, have chemical properties identical with those of some already known element. Uranium-*X* and radioactinium are chemically similar to and non-separable from thorium, mesothorium-2 is non-separable from actinium, thorium-*B* is non-separable from lead, radium-*B* and actinium-*B* are extremely similar to lead and most probably non-separable from it; thorium-*C*, radium-*C*, and actinium-*C* are very closely allied to bismuth, and probably chemically similar to it. The present view that there is only one product, radium-*E*, between radio-lead and polonium has been confirmed by the direct measurement of the growth of radium-*F* from radium-*E*. Radium-*E* has chemical properties identical in all respects with those of bismuth.

10. "The action of ammonia and alkylamines on reducing sugars."

By James Colquhoun Irvine, Robert Fraser Thomson, and Charles Scott Garrett.

The action of ammonia, in methyl-alcoholic solution, on various sugar derivatives has been re-investigated. The reactions were carried out in the cold, and in the absence of a catalyst. From the fact that sucrose, α -methylglucoside, and tetramethyl α -methylglucoside were unaffected under these conditions whilst gluconolactone was converted into *gluconamide*, the deduction is made that the formation of the so-called "imines" of the sugars is due to condensation of the reducing group with one molecule of ammonia.

These imines are thus to be regarded as unstable amino-sugars, and the absence of salt formation is due to the ready hydrolysis of the complexes. According to this view of the structure of these compounds, reducing sugars should be capable of condensation with both primary and secondary amines, and it is now shown that glucose reacts with ethylamine, diethylamine, and dimethylamine to give *ethylaminoglucose*, *diethylaminoglucose*, and *dimethylaminoglucose* respectively. Ethylaminoglucose is crystalline, and shows measurable mutarotation, and the same change was detected in the case of "glucoseimine."

The action of ammonia on lævulose gave, in addition to 2:5-dihydroxybutylpyrazine, a second product, $C_6H_9O_4N$, which, although inactive, was converted into glucosephenylosazone, displaying the normal rotation. The constitution of this product, and

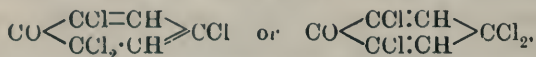
the possible cause of the great variation in stability shown by amino-sugars were discussed.

11. "Th chlorination of iodophenols. Part II. The chlorination of *o*-haloid derivatives of *p*-iodophenol." By George King and Hamilton McCombie.

The work described by Brazier and McCombie (T., 1912, 101, 968) on the chlorination of *p*-iodophenol has now been extended to other *p*-iodophenols in which one or both of positions 2 and 6 is occupied by another halogen atom.

Willgerodt (*Ber.*, 1892, 25, 3495) states that when 2:4:6-tri-iodophenol is chlorinated in chloroform solution only an oily substance results. The authors have confirmed this result, but were able to obtain an iodo-dichloride when either carbon tetrachloride or light petroleum was employed as the solvent. This iodo-dichloride is more stable than the one derived from *p*-iodophenol, and differs further from the latter compound in that on decomposition chlorine is liberated and tri-iodophenol is regenerated.

As both the solvent and the temperature employed in these chlorinations had an influence on the products obtained, a detailed study of these influences was made. In glacial acetic acid at 15° the main products of the reaction were (1) a tetrachloro-compound:



and (2) chloroanil. In boiling acetic acid solution a copious yield of chloroanil was obtained.

2:6-Dibromo-4-iodophenol gave an iodo-dichloride which resembled the compound derived from tri-iodophenol in that on decomposing chlorine is evolved and the original phenol is regenerated. It has been shown by Brazier and McCombie that 2:6-dichloro-4-iodophenol can be converted into an iodo-dichloride which decomposes with evolution of hydrogen chloride and the formation of a further substitution product. Hence the presence of two bromine or two iodine atoms in positions 2 and 6 protects the hydrogen atoms 3 and 5 from attack.

2:4-Di-iodophenol and 2-bromo-4-iodophenol both yield iodo-dichlorides which on decomposing lose hydrogen chloride and give 6-chloro-2:4-di-iodophenol and 6-chloro-2-bromo-4-iodophenol respectively.

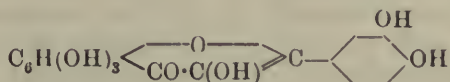
While the iodophenols described yield unstable iodo-dichlorides, it has been found in this case, as was noticed in the case of *p*-iodophenol, that the acyl derivatives yield stable iodo-dichlorides.

In the case of all the polyiodo-compounds which are described it was found that only one of the iodine atoms becomes tervalent.

In these cases evidently the hydroxyl and acyl groups destroy the tervalency of the iodine atoms in the same way as the methyl group does in 2:4-di-iodotoluene (Willgerodt and Simonis, *Ber.*, 1906, **39**, 269) and the nitro-group in 3:5-di-iodonitrobenzene (Willgerodt and Ernst, *Ber.*, 1901, **34**, 3406).

12. "Quercetagetin." By Arthur George Perkin.

Quercetagetin, $C_{15}H_{10}O_8$, the colouring matter of the African marigold (*Tagetes patula*) (P., 1902, **18**, 75), when methylated with excess of methyl iodide and alkali gives *quercetagetin pentamethyl ether*, $C_{15}H_5O_3(OMe)_5$, pale yellow needles, m. p. 161—162°, and *quercetagetin hexamethyl ether*, $C_{15}H_4O_2(OMe)_6$, colourless needles, m. p. 157—158°. *Quercetagetin hexaethyl ether*, $C_{15}H_4O_2(OEt)_6$, colourless needles, m. p. 139—141°, by hydrolysis with alcoholic potassium hydroxide gives protocatechuic acid diethyl ether, and a ketone, *quercetagetol tetraethyl ether*, $HO \cdot C_6H(OEt)_3 \cdot CO \cdot CH_2 \cdot OEt$, prismatic needles, m. p. 46—48°, which yields the *oxime*, $C_{16}H_{25}O_6N$, m. p. 93—95°, and with permanganate an acid (*quercetagetinic acid*), needles, m. p. 100—102°. The pentahydroxyflavonol constitution:



is assigned to quercetagetin, which is thus isomeric with myricetin (T., 1911, **99**, 1721), but the positions of the hydroxyl groups, O:OH:OH:OH, in the tetrahydroxybenzene nucleus have not yet been decided. Acetylquercetagetin melts at 209—211°, and not at 203—205° as previously stated.

13. "Hydroxyquinol-phthalein anhydride and hydroxyquinol-benzein." By Kedar Nath Ghosh and Edwin Roy Watson.

From certain theoretical considerations it was argued that gallein, pyrogallol-benzein, and a compound obtained from benzaldehyde and pyrogallol by condensation with hydrochloric acid (K. Hofmann, *Ber.*, 1893, **26**, 1139) should have valuable dyeing properties. It was found that pyrogallol-benzein has dyeing properties equally as good as those of gallein, but its good properties have probably been overlooked on account of an unfavourable report (Doebner and Forster, *Annalen*, 1890, **257**, 63). The condensation of benzaldehyde and pyrogallol gives no dyestuff.

Hydroxyquinol-phthalein anhydride, $C_{20}H_{12}O_7$, obtained by condensing hydroxyquinol and phthalic anhydride, separates from

alcohol in red crystals; it forms a *tetra-acetyl* derivative, $C_{20}H_9O_3(OAc)_4$, crystallising from benzene in colourless, rhombic form, melting at 267° . It dyes mordanted wool scarlet on alum and tin, violet on chrome, and brownish-black on iron mordants. The shades are not fast.

Hydroxyquinol-benzein, $C_{33}H_{24}O_{11}$, was produced by condensing hydroxyquinol and benzotrichloride. It is obtained as a dark red, amorphous substance by hydrolysing the pure *tetra-acetyl* derivative, $C_{33}H_{20}O_7(OAc)_4$, which separates from benzene in yellow, needle-shaped crystals, melting at 235° . Hydroxyquinol-benzein dyes exactly the same shade as the corresponding phthalein anhydride, and the dyeings are also not fast.

14. "2:2'-Ditolyl-5:5'-dicarboxylic acid."

By James Kenner and Ernest Witham.

The *dinitrile*, m. p. 158° , *dimethyl ester*, m. p. 134° , and *diethyl ester*, m. p. 76° , of 2:2'-ditolyl-5:5'-dicarboxylic acid were prepared by the action of copper powder on the corresponding derivatives of *o*-iodo-*p*-toluic acid.

Tetramethyl diphenyl-2:5:2':5'-tetracarboxylate, m. p. 156° , was obtained in a similar manner from dimethyl iodoterephthalate.

The properties of certain of these compounds differed from those observed by Liebermann in compounds to which he attributed the same constitution, and the conclusion was drawn that the latter derivatives were differently constituted.

15. "The carbonylferrocyanides."

By Herbert Ernest Williams.

The carbonylferrocyanides exist in the mother liquor resulting from the working up of "cyanogen mud." They can be recovered by precipitating with ferric salts, boiling the precipitate with lime, precipitating the ferrocyanide present as calcium ammonium ferrocyanide, by converting a portion of the liquor into the ammonium salt, mixing with the bulk, and boiling.

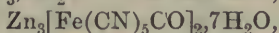
The filtrate is boiled with lime to remove the excess of ammonia and the salt allowed to crystallise. The salts of the alkali- and alkaline earth-metals, including lithium and magnesium, are very soluble, and several are deliquescent. The salts of the heavy metals are for the most part insoluble in water; lead, chromic, stannic, and alumina salts produce no precipitate.

The following salts were described: *Ammonium salt*,



dimethylaniline salt, $(C_6H_5 \cdot NMe_2)_3H_3Fe(CN)_5CO \cdot 8H_2O$, sparingly soluble; *diethylaniline* salt, $(C_6H_5 \cdot NEt_2)_3H_3Fe(CN)_5CO \cdot 3H_2O$, sparingly soluble; *barium* salt, $Ba_3[Fe(CN)_5CO]_2 \cdot 14H_2O$. The *calcium* salt, $Ca_3[Fe(CN)_5CO]_2 \cdot 8H_2O$, is deliquescent, and forms *double salts*, $CaKFe(CN)_5CO \cdot 5H_2O$ and $CaNH_4Fe(CN)_5CO$. The *cobalt* salt, $Co_3[Fe(CN)_5CO]_2 \cdot 18H_2O$, is reddish-pink, loses $13H_2O$ at 100° , and turns blue; it also forms the *salt*, $Co_4K[Fe(CN)_5CO]_3 \cdot 21H_2O$. The *cadmium* salt, $Cd_3[Fe(CN)_5CO]_2 \cdot 7H_2O$, is white, and becomes anhydrous at 100° ; the *cupric* salt, $Cu_3[Fe(CN)_5CO]_2 \cdot 14H_2O$, is pale green, and loses $7H_2O$ at 100° ; when crystallised from ammonia it gives the *salt*, $Cu_3[Fe(CN)_5CO]_2 \cdot 3NH_3 \cdot 9H_2O$, which is olive-green, and also forms the *salt*, $Cu_7K_4[Fe(CN)_5CO]_6 \cdot xH_2O$. The *lithium* salt, $Li_3Fe(CN)_5CO \cdot 4H_2O$, is deliquescent, and loses $2H_2O$ at 100° . The *magnesium* salt, $Mg_3[Fe(CN)_5CO]_2 \cdot 16H_2O$, loses $10H_2O$ at 100° ; the *manganese* salt, $Mn_3[Fe(CN)_5CO]_2 \cdot 18H_2O$, is white, loses $15H_2O$ at 100° , and when oxidised with nitric acid forms a dark brown *manganomanganic* salt.

The *nickel* salt, $Ni_3[Fe(CN)_5CO]_2 \cdot 13H_2O$, is apple-green, loses $6H_2O$ at 100° , and with ammonia gives the pale blue *salt*, $Ni_3[Fe(CN)_5CO]_2 \cdot 2NH_3 \cdot 4H_2O$. The *zinc* salt,



is white, loses $4H_2O$ at 100° , and gives with ammonia the *salt*, $Zn_3[Fe(CN)_5CO]_2 \cdot 4NH_3 \cdot 4H_2O$.

16. "The so-called disodium derivative of diethyl malonate."

By Alexander Killen Macbeth and Alfred Walter Stewart.

In the course of an investigation of the absorption spectra of malonic acid derivatives, the results of which will be published shortly, the authors have been led to examine the spectra of solutions of diethyl malonate and diethyl methylmalonate in the presence of sodium ethoxide; and as the results do not form part of the main work they are now published.

It was for some time assumed that diethyl malonate was capable of forming both a mono- and a disodium derivative. The latter substance would have the composition $Na_2C_7H_{10}O_4$; but Vorländer (*Ber.*, 1903, **36**, 268) threw considerable doubt on its existence, as molecular-weight determinations in boiling alcohol (Vorländer and Schilling, *ibid.*, 1899, **32**, 1876) showed that it behaved as if it were a mere mixture of the monosodium derivative with sodium ethoxide. Vorländer concluded from an examination of the conductivities of solutions of the free ester, the sodium derivative, and sodium ethoxide, that a true sodium substitution product was present, and not a mere additive compound of one molecule of ester

plus one molecule of sodium ethoxide. To this substance he ascribed the formula $\text{CHNa}(\text{CO}_2\text{Et})_2$, thus representing it as a *C*-derivative and not an *O*-derivative. Considerable doubt is thrown on this conclusion by the later work of Haller and Muller (*Compt. rend.*, 1904, **139**, 1180), for by means of the refractometric method they were able to show that malonic derivatives were salts of ψ -acids having the metallic atom attached to a non-carbon atom. On this assumption, the formula of the monosodium derivative of diethyl malonate would be $\text{NaO}\cdot\text{C}(\text{OEt})\text{:CH}\cdot\text{CO}_2\text{Et}$, whilst the disodium derivative would be $\text{NaO}\cdot\text{C}(\text{OEt})\text{:C:C}(\text{OEt})\cdot\text{ONa}$. Substances of such structures should differ very considerably from one another, and it seemed possible that some fresh evidence might be obtained from this point of view with regard to the existence of the supposed disodium derivative.

Diethyl malonate in the presence of excess of sodium ethoxide shows a band in its spectrum which is not found in that of the free ester. The band has its head at oscillation frequency 3900, and occurs in *N*/1000-ester solution in the presence of *N*/10-sodium ethoxide. This band might be due to the presence of either a mono- or di-sodium derivative. In order to decide between the two, the spectrum of diethyl methylmalonate in the presence of excess of sodium ethoxide was photographed, and it was found that the band observed in this case was exactly similar to the other, although it occurred at a higher concentration (*N*/100-ester with *N*/10-sodium ethoxide). Since in diethyl methylmalonate only one displaceable hydrogen atom remains, it seems fair to conclude from the resemblance between the spectra that only one hydrogen atom is displaced by sodium in diethyl malonate; and that even in the presence of excess of sodium ethoxide no disodium derivative is produced.

The reason for the difference in the dilutions at which the heads of the two bands appear may be traced, in part at least, to the fact that although the concentration of sodium ethoxide is the same in both cases, in the solution of diethyl malonate there are two hydrogen atoms capable of being displaced for every one such hydrogen atom in the diethyl methylmalonate solution. Hence the amount of sodium derivative formed will be less in the latter case than in the former.

This view is strengthened by the fact that when a series of solutions containing sodium ethoxide and diethyl malonate were examined, the penetration of the band was found to diminish as the quantity of ethoxide was decreased, that is, as the number of collisions between ethoxide and ester molecules was lessened. It seems evident that spectroscopic evidence cannot be brought into

agreement with the idea of the existence of a disodium derivative of diethyl malonate.

The following figures give the outlines of the various curves. The dashes indicate the region of the bands, and the figures on the left hand represent the logarithms of thicknesses of $N/100,000$ -solution.

Diethyl Malonate in the Presence of N/10-Sodium Ethoxide.

Log. thicknesses.	Spectrum transmitted to $1/\lambda$.
50	340
40	352
30	363
24	366
23	369—414, 428
22	373—400, 430
21	Head of band, 434
20	438

Diethyl Methylmalonate in the Presence of N/10-Sodium Ethoxide.

Log. thicknesses.	Spectrum transmitted to $1/\lambda$.
40	344
33	365
32	367—414, 428
31	367—413, 428
30	Head of band, 428

Diethyl Malonate (N/100) in the Presence of N/1000-Sodium Ethoxide.

Log. thicknesses.	Spectrum transmitted to $1/\lambda$.
49	418
40	444

Diethyl Malonate (N/1000) in the Presence of N/100-Sodium Ethoxide.

Log. thicknesses.	Spectrum transmitted to $1/\lambda$.
39	363
36	367—414, 434
34	367—414, 442
33	374—400, 444
32	Head of band, 444

Diethyl Methylmalonate (N/100) in the Presence of N/500-Sodium Ethoxide.

Log. thicknesses.	Spectrum transmitted to $1/\lambda$.
49	367
48	371
47	371
46	423
40	442

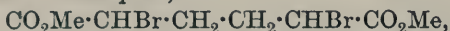
Diethyl Methylmalonate (N/1000) in the Presence of N/50-Sodium Ethoxide.

Log. thicknesses.	Spectrum transmitted to $1/\lambda$.
39	367—413, 427
38	367—413, 427
37	373—400, 428
36	Head of band, 428
30	444

17. " **$\alpha\delta$ -Derivatives of adipic and β -methyladipic acids ; and the preparation of muconic and β -methylmuconic acids.**" By Henry Stephen and Charles Weizmann.

A full description was given of the compounds of which a preliminary account has been published (P., 1912, **28**, 94), and also of the following:

Methyl $\alpha\delta$ -dibromoadipate,



crystallises from alcohol in white needles melting at 75° , and distilling at $182^\circ/10$ mm. The corresponding *ethyl* ester melts at 65° and distils at $195^\circ/10$ mm.

Muconic acid melts and decomposes at 298° . The methyl ester melts at 158° , and distils at $185^\circ/12$ mm. The *ethyl* ester distils at $200^\circ/12$ mm.

β -Methylmuconic acid, $\text{CO}_2\text{H}\cdot\text{CH}\cdot\text{CMe}\cdot\text{CH}\cdot\text{CH}\cdot\text{CO}_2\text{H}$, is a white, crystalline powder melting and decomposing at 235° . The *methyl* ester distils at $145^\circ/9$ mm., and the *ethyl* ester at $175^\circ/10$ mm.; both are colourless liquids.

18. "**The measurement of tryptic protein hydrolysis by determination of the tyrosine liberated.**" By Samuel James Manson Auld and Thomas Duncan Moss crop.

Brown and Millar's method of following tryptic protein hydrolysis cannot be carried out in ordinary protein digests without the use of an external indicator, since the bromination of tyrosine is not momental towards the end of the reaction. Starch and iodine cannot be used to detect the end-point, since the solution is acid. A suitable indicator for small quantities of bromine (in the presence of sodium bromide) is methyl-violet, which shows marked colour changes.

19. "**The interaction of iodine and thiocarbamide.**"

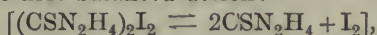
By Hugh Marshall.

In the *Transactions* for November last there appears a paper by E. A. Werner on "The Interaction of Iodine and Thiocarbamide. The Properties of Formamidine and its Salts," in which the author

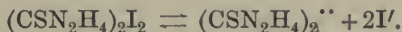
refers to work done by me in connexion with the same subject (*Proc. Roy. Soc. Edin.*, 1902, **24**, 233). The statements regarding my work and views are so inaccurate that I can only assume that they have been based on some abstract of my paper, and not on the paper itself; thus, on p. 2169 of Werner's paper it is stated, in reference to my work and earlier work by McGowan: "Unfortunately both these investigators were misled as regards the true nature of the compound formed, which they considered to be an additive compound, 'dithiocarbamide di-iodide,' $(\text{CSN}_2\text{H}_4)_2\text{I}_2$, the formation of hydriodic acid and the saline character of the substance having escaped their attention."

As my original paper is not readily accessible to chemists generally, it may be permissible to quote the following passages from it, to show how incorrect the above statement is, so far as it regards my views, and to show that much of what is contained in Werner's paper had already been made known.

On p. 236 (*loc. cit.*): "The nature of such a second reaction is suggested by the saline nature of the compound, and the phenomena are explicable on the assumption that in aqueous solution the di-iodide undergoes ionisation, and that the increased ionisation produced by the dilution is the cause of the diminished dissociation. In addition to the first balanced action:

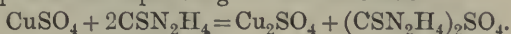


we may therefore assume the second one, represented by the equation:



"This assumption that the di-iodide and its analogues are true salts is justified by the readiness with which they undergo double decomposition with other salts, as exemplified by the precipitation of the sparingly soluble dinitrate. Further, the aqueous solution of the di-iodide dissolves free iodine, like solutions of metallic iodides; it precipitates lead iodide and silver iodide from solutions of lead and silver salts; with mercuric chloride it gives a precipitate of mercuric iodide, soluble in excess of the di-iodide."

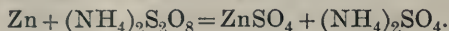
On p. 238: "It will be observed that thiourea is to a certain extent analogous to a metal; a molecule of it corresponds to half an atom of a dyad metal. Like a metal, it unites directly with the halogens to form salts. It can 'reduce' metallic salts from a higher to a lower stage; thus, Rathke (*Ber.*, 1884, **17**, 297) found that it acts upon cupric sulphate to form cuprous sulphate—momentarily—and the sulphate corresponding to the di-iodide:



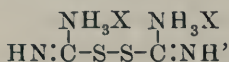
The cuprous sulphate unites with more thiourea to form a complex compound. Other cupric salts behave in a similar manner.

"When thio-urea is added to a concentrated solution of ammonium persulphate there is a considerable evolution of heat, and, on cooling, the above sulphate separates out, whilst ammonium sulphate remains in solution:

$2\text{CSN}_2\text{H}_4 + (\text{NH}_4)_2\text{S}_2\text{O}_8 = (\text{CSN}_2\text{H}_4)_2\text{SO}_4 + (\text{NH}_4)_2\text{SO}_4$,
corresponding to such an action as:



"The exact constitution of the class of salts here dealt with does not appear to have been very fully investigated, and in what precedes I have simply adopted the formulæ generally employed. Adopting the imide formula for thiourea, the most plausible assumption is that the salts may be represented by the graphic formula:



The difficulty of satisfactorily investigating this and other points is considerable, owing to the instability of the hydroxide of the corresponding amine base."

In the interval since the publication of my paper I have, in conjunction with Mr. Blackadder, studied these substances further, and the publication of the results has only been delayed in order to allow of completion of certain details. At the Dundee meeting of the British Association I made a short contribution on the subject, especially with regard to analogous compounds containing the group $\cdot\text{S}\cdot\text{S}\cdot\text{S}\cdot$ in place of $\cdot\text{S}\cdot\text{S}\cdot$.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Annals of Philosophy; or, magazine of chemistry, mineralogy, mechanics, natural history, agriculture, and the arts. By *Thomas Thomson*. 16 vols. London 1813-1820. [*Vols. 1 and 2, second edition.*]

— New series. [Edited by *Richard Phillips*. 12 vols. London 1821-1826. (*Reference.*) From Mr. J. A. Audley.

II. *By Purchase.*

Brislee, F. J. An introduction to the study of fuel. London 1912. pp. xxii + 269. ill. 8s. net. (*Recd. 12/12/12.*)

Höfer, Hans von. Das Erdöl und seine Verwandten. 3rd edition. Braunschweig 1912. pp. xvi + 351. M. 12.—. (*Recd. 12/12/12.*)

Hoffmann, M. K. Lexikon der anorganischen Verbindungen. Vol. I., etc. Leipzig 1910+. (*Reference.*)

Köhler, Hippolyt. Die Fabrikation des Russes und der Schwärze. 3rd edition. Braunschweig 1916. pp. viii + 229. ill. M. 7.—. (*Recd. 12/12/12.*)

Landolt, Hans Heinrich, Börnstein, Richard, and Roth, Walther A. [With others.] Physikalisch-chemische Tabellen. 4th edition. Berlin 1912. pp. xvi + 1313. M. 56.—. (*Reference.*)

III. *Pamphlets.*

Beam, William. The determination of humus, especially in heavy clay soils. (From *The Cairo Sci. J.*, 1912, 6.)

Bocci, Balduino. La semplificazione degli enzimi col metodo combinato dell' autolisi e della dialisi. (From the *Proc. verb. R. Accad. Fisiocritici, Siena*, 1912.)

Bruni, G. Reazioni di doppio scambio in chimica organica. (From the *Atti R. Inst. Veneto Sci.*, 1911, 70.)

Bruni, G., and Amadori, M. Sul calore di formazione delle soluzioni solide. (From the *Atti R. Inst. Veneto Sci.*, 1911, 71.)

Bruni, G., and Meneghini, D. Sulla formazione di soluzioni solide fra sali alcalini per diffusione allo stato cristallino. (From the *Atti R. Inst. Veneto Sci.*, 1911, 71.)

Gramont, Arnaud de. Sur les spectres stellaires et leur classification. (From the *Annuaire Bur. des Longitudes*, 1911.)

Gramont, Arnaud de. Nouvel appareil a spectres d'étincelles des liquides sans raies d'électrodes. (From the *Compt Rend. Assoc. Francaise Avance. Sci.*, 1910.)

—— Notice sommaire sur les travaux scientifiques. pp. 36. Paris 1910.

(Together with 16 reprints of papers published in journals already in the Library.)

Harrison, W. H., and Sivan, M. R. Ramaswami. A contribution to the knowledge of the black cotton soils of India. (From the *Mem. Dept. Agric. India, Chem. Series*, 1912, 2.)

Inghilleri, G. Azione dell' anilina sui sali di uranile. (From the *Atti R. Accad. Fisiocritici, Siena*, 1911.)

Inghilleri, G., and Gori, G. Su alcuni sali complessi della chinolina con i sali d'uranile. (From the *Atti R. Accad. Fisiocritici, Siena*, 1909.)

Jona, Temistocle. Crioscopia degli estratti di carne. pp. 15. Fossano 1911.

—— Ricerca di dipeptidi nelle sostanze estrattive dei muscoli. pp. 19. Fossano 1911.

—— Sui composti azotati contenuti nell' estratto di carne. pp. 87. Fossano 1911.

Komppa, Gust. Ueber das γ - γ -dimethylpiperidin. (From the *Ann. Acad. Sci. Fennicæ*, 1911, A, 3.)

Luzzatto, R., and Satta, G. Intorno al comportamento nell' organismo animale del Parajodanisolo. (From the *Arch. Farm. speriment.*, 1912, 13.)

Miyake, K. Ueber das Verhalten der Pentosane und Methylpentosane der Samen von Glycine hispida und von Phaseolus vulgaris während des Keimungsvorganges. (From the *J. Coll. Agric., Tohoku Imp. Univ., Sapporo, Japan*, 1912, 4.)

—— An improvement of the method for the determination of Galactan. (From the *J. Coll. Agric., Tohoku Imperial University*, 1912.)

Ottolenghi, Donato. Ueber die Wirkung der Säuren der Basen und einiger Salze auf die bakteriziden Sera. (From the *Zeitsch. Immunitätsforsch. exp. Ther.*, 1912.)

Rây, Prafulla Chandra, and Datta, Rasik Lal. On isomeric allyl-amines. (From the *J. and Proc., Asiatic Soc. Bengal*, 1912, N.S. 8)

Rothermundt, M., and Dale, J. Experimentelle Studien über die Wirkungsweise des Atoxyls in vitro und im Tierkörper. (From the *Zeitsch. Immunitätsforsch. exp. Therapie*, 1912, 12.)

Rupp, E., and Kropat, K. Ueber eine einfache Bestimmung des Gesamtquecksilbers in Hydrargyrum sulcylicum. (From the *Apoth. Zeit.*, 1912.)

Schirmer, Wolfgang. Beiträge zur chemischen Kenntnis der Gummi- und Schleimarten. pp. 67. Strassburg i.E. 1911.

Schmidt, Ernst. Ueber das Kreatinin. (From the *Apoth. Zeit.*, 1912).

——— Ueber die Darstellung des Glycocyamidins. (From the *Zeitsch. Allg. Oesterr. Apothekervereins*, 1912.)

Schottky, Hermann. Ueber die Veränderungen von Blattmetallen beim Erhitzen infolge von Oberflächenkräften. (From the *Nachr. k. Ges. Wiss. Göttingen*, 1912.)

Tammann, G. Ueber die Abhängigkeit der Krystallform von der Temperatur und die Rekristallisation in Konglomeraten. (From the *Nachr. K. Ges. Wiss. Göttingen*, 1912.)

Tammann, G. Zur Thermodynamik der Gleichgewichte in Einstoffsystemen. (From the *Nachr. k. Ges. Wiss. Göttingen*, 1911).

Valenti, Adriano. Contributo allo studio del comportamento nell'organismo di alcuni derivati arsenicali organici (salvarsan e cacodilato di sodio. (From the *Arch. Farm. speriment.*, 1912, 11.)

Vassiliev, A. M. The origin of the names of the chemical elements. An attempt at a compilation. pp. 40. Kasan 1912. [In Russian.]

Venth, Ernst. Ueber emulsinartige Enzyme. pp. 53. Strassburg, i.E. 1912.)

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Metropole, at 7 for 7.30 o'clock, on Friday, March 14th, 1913 (the day fixed for the Annual General Meeting).

The Council has decided to invite Fellows to become Stewards for this Dinner, the additional liability of each Steward not to exceed 10s. 6d.

The price of the tickets will be One Guinea each, including wine, and half a guinea each, not including wine. All applications for tickets must be received not later than Friday, March 7th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to "Mr. S. E. Carr," and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on Thursday, February 6th, 1913, at 8.30 p.m., the following papers will be communicated :

"The presence of helium in the gas from the interior of an X-ray bulb." By Sir William Ramsay.

"The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures." By J. N. Collie and H. Patterson.

"Vaubel's supposed phenyldi-imine." By M. O. Forster and J. C. Withers.

"The mode of combustion of carbon." By T. F. E. Rhead and R. V. Wheeler.

"The latent heat of vapours." (Preliminary note.) By M. P. Applebey and D. L. Chapman.

"Some derivatives of *o*-xylene." (Preliminary note.) By J. L. Simonsen.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 29

No. 410.

Thursday, February 6th, 1913, at 8.30 p.m., Prof. A. SMITHELLS, F.R.S., in the Chair.

Messrs. H. E. Annett, M. P. Applebey, E. Jobling, and A. K. Menon were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Edward Cahen, 32, Queen's Road, Bayswater, W.

Alexander Caruth, 101, Singleton Avenue, Prenton, Birkenhead.

Harold Edward Pollock Hodsoll, 22, Pembridge Mansions, Bayswater, W.

Douglas Rayment Keller, B.Sc., 48, Weymouth Street, Watford.

Arthur George Abraham Miller, B.Sc., 1, Pretoria Terrace, Waltham Cross.

Sosale Garalapury Sastry, B.A., Kavitha Vilas, Mysore, India.

Thomas Harrison Winstanley, 45, Dicconson Street West, Wigan.

Clifton Wyver, 37, Boulton Street, Wolstanton, Stoke-on-Trent.

Of the following papers, those marked * were read:

- *20. "The presence of helium in the gas from the interior of an X-ray bulb." By Sir William Ramsay, K.C.B.

Helium containing a trace of neon was found after absorbing the condensable gases by cooled charcoal from the gases obtained on heating the broken pieces of three X-ray bulbs, which use had coloured deep violet. In a second set of experiments, the bulbs

were not broken, but attached to a Töpler pump by an air-tight connexion. The bulbs were heated to 350° , connexion was made between the interior of the bulb and the pump, and the gases were similarly tested. Again helium was found, containing, as before, a trace of neon. The bulbs were then broken, and the glass was examined for the same gas. Not a trace was found; it had all been expelled during the previous operation.

*21. "The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures." (Preliminary note.) By John Norman Collie and Herbert Sutton Patterson.

In a letter to *Nature* last July (89, 502) Sir William Ramsay mentioned that one of the authors (J. N. C.) had noticed that calcium fluoride under the action of cathode rays emitted a gas, and that the gas contained traces of neon. Since then many more experiments have been made, both with and without calcium fluoride, it being found that so long as there were traces of hydrogen in the tube, neon could always be detected in the gas that had been submitted to the passage of the electric discharge at low pressures. In the meantime the other author (H. S. P.) had been engaged on the same research, but had approached it from another point of view. Neither of the authors was aware of the work of the other until the end of November, when, as they had both obtained the same results, it seemed best to publish the results in a joint paper.

The experiments were carried out in an *X*-ray bulb or in an ordinary large-sized Pflücker tube, the hydrogen being obtained either from sodium amalgam and boiled water, or by the electrolysis of barium hydroxide solution. After the hydrogen had been submitted to the electric discharge for several hours, at varying pressures from 1 mm. down to an *X*-ray vacuum and the pump being kept working most of the time, the collected hydrogen was mixed with excess of pure oxygen, prepared by heating potassium permanganate, and exploded. The residual oxygen was then introduced into an apparatus (invented by Sir W. Ramsay), where the oxygen could be absorbed by charcoal immersed in liquid air (and the authors take the opportunity of calling attention to this invaluable discovery of Sir J. Dewar, without which the neon in the gas could never have been detected); the residual gas was then driven up into a narrow capillary bore tube with a platinum wire sealed into the top. By freezing the mercury in the capillary tube, and then allowing a spark to pass through the gas from the mercury to the platinum wire, the spectrum of neon was always noticed.

Great care was always taken to be sure that no air leaked into the apparatus during the experiment; also careful tests were made to see that there was no air either in the hydrogen or the oxygen used, and blank experiments were always made by exploding large quantities of the oxygen and hydrogen employed, and unless the hydrogen had been submitted to the electric discharge, neon was always absent in the residual oxygen. The amount of air necessary to produce the quantity of neon usually found would be about 1 to 2 c.c. In one experiment, where enough neon had been found to give the ordinary flame-coloured appearance when sparked, the oxygen absorbed by the charcoal and liquid air was carefully pumped off and absorbed by phosphorus; a small bubble of gas the size of a large pin's head remained. This gas, however, when examined in a spectrum tube was found to be not residual nitrogen from an air leak, but hydrogen. The neon therefore found in hydrogen that has been sparked at low pressures in an *X*-ray vacuum is not due to air leaking into the apparatus during the experiment.

Addendum.—Since the above communication was submitted to the Chemical Society some fresh facts have been obtained by one of the authors (J. N. C.). In order to be certain that the neon had not leaked in from the outside air, through the glass, when the glass was under the influence of the cathode discharge, a tube was made in which that end of the apparatus was inside another tube.

The outside tube was then filled, first with neon, and secondly helium, the inner tube containing the hydrogen. In both cases neon was found in the hydrogen as before, and not a trace of helium leaked in.

A final experiment was made with an entirely fresh apparatus, in which the whole inner tube was encased in an outer one. Again neon was found in the hydrogen that was sparked in the inner tube.

The vacuum in the outer tube was below that of an *X*-ray bulb for the spark would not pass through it. It was thought worth while to wash out this outer tube after the experiment with 1 c.c. of pure oxygen. The oxygen was then absorbed by charcoal cooled with liquid air, and a residue remained at least fifty times as great as the residue from the gas in the inner tube. It was a mixture of helium and neon, the helium being in excess. This result has been confirmed by the other author (H. S. P.), who has also found that if the outer tube is filled with oxygen under 10 cm. pressure, the residual gas in the outer tube, instead of being mostly helium, is mostly neon.

***22. "Vaubel's supposed phenyldi-imine."**

By Martin Onslow Forster and John Charles Withers.

Proceeding in the manner described by Vaubel (*Ber.*, 1900, **33**, 1711), the authors failed to produce phenyldi-imine, obtaining instead a constant boiling mixture of phenylazoimide and aniline. The percentage composition of a mixture, $C_6H_5 \cdot N_3 + C_6H_5 \cdot NH_2$, is identical with that of the supposed phenyldi-imine, $C_6H_5 \cdot N : NH$, and the properties ascribed by Vaubel to this individual accord with those of the mixture in question.

***23. "The latent heat of vapours." (Preliminary note.)**

By Malcolm Percival Applebey and David Leonard Chapman.

On the assumption that the characteristic equation of a liquid and its vapour can be expressed by the equation:

$$p(v-b) = Rt,$$

in which p is the total pressure (the sum of the external and internal pressures), b a function of the temperature only, R the gas constant, and t the absolute temperature, the authors have deduced thermodynamically that the molecular latent heat of a vapour is given by the equation:

$$L = Rt \log_e \frac{v_2 - b}{v_1 - b} + Rt \left(\frac{1}{v_1 - b} - \frac{1}{v_2 - b} \right) t \frac{db}{dt}.$$

L being the molecular latent heat, and v_2 and v_1 the molecular volumes of the liquid and vapour respectively.

With the aid of S. Young's determination of the latent heat of n -pentane vapour (*Sci. Proc. Roy. Dubl. Soc.*, 1910, **12**, 414), it has been shown that $\frac{db}{dt}$ is probably almost constant between 30° and 180° , and equal to 0.0892 . The value of b at the critical point is a little greater than a third of the critical volume.

In the following table the observed latent heats of n -pentane are compared with those calculated from the above formula.

Latent Heats of n-Pentane between 30° and 190° .

$b = 120.30$ at the critical point; $\frac{db}{dt} = 0.0892$.

Temperature.	L (observed).	L (calculated).	Temperature.	L (observed).	L (calculated).
30°	85.76	86.02	130°	60.85	60.60
40	84.31	83.22	140	56.58	56.57
50	82.13	82.03	150	52.39	52.34
60	80.07	79.98	160	47.42	47.46
70	77.77	77.73	170	42.06	42.09
80	75.33	75.34	180	35.01	35.30
90	72.73	72.73	190	24.68	24.51
100	69.94	69.93	197.15	0.0	0.0
110	67.31	67.16	(critical temp.)		
120	64.48	64.06			

The validity of the formula can be tested with the aid of the discovery of J. E. Mills (*J. Physical Chem.*, 1905, **9**, 402) that $\frac{dp}{dt} = \frac{2R}{v}$ at the critical point. For, writing the above equation in the form:

$$L = R t \log_e \left(1 + \frac{v_2 - v_1}{v_1 - b} \right) + R t \frac{v_2 - v_1}{(v_1 - b)(v_2 - b)} t \frac{db}{dt},$$

it will be seen that at a temperature just below the critical point, when $v_2 - v_1$ is small, it reduces to:

$$\frac{L}{v_2 - v_1} = R t \left\{ \frac{1}{v_1 - b} + \frac{1}{(v_1 - b)^2} t \frac{db}{dt} \right\},$$

and

$$\frac{L}{v_2 - v_1} = t \frac{dp}{dt}.$$

$$\therefore \frac{dp}{dt} = R \left\{ \frac{1}{v_1 - b} + \frac{1}{(v_1 - b)^2} t \frac{db}{dt} \right\}.$$

Introducing the values 120.30 and 0.0892 for b and $\frac{db}{dt}$ respectively, and putting v_1 equal to 309.95, the value given by Young for the critical volume, one obtains:

$$\frac{dp}{dt} = 1.996 \frac{R}{v_1},$$

and this is in close agreement with the formula discovered by Mills.

This investigation furnishes evidence for the view that b increases at a uniform rate from the absolute zero to the critical point, and that it does not diminish as Roth found for ethylene (*Ann. Phys. Chem.*, 1880, [iii], **11**, 1). The discrepancy between Roth's conclusion and the authors' is probably accounted for by the fact that Roth made the same assumption as van der Waals, namely, that the internal pressure is at all temperatures proportional to the square of the density, whereas the authors' speculations are independent of any assumption as to the value of this magnitude.

It is obvious that, on the assumption that $\frac{db}{dt}$ is constant, values of b can be calculated from Mills' relation and the law of rectilinear diameter quite independently of the latent heats, and that these values can be used to calculate the latent heats.

DISCUSSION.

Mr. MERRIMAN pointed out that Professor Young's values for the latent heats of vapours could not strictly be called "observed" values, as they were calculated from the thermodynamical formula:

$$L = (v_1 - v_2) \cdot \frac{T}{J} \cdot \frac{dp}{dt}$$

the quantities v_1 , v_2 , $\frac{dp}{dt}$ being read from smoothed curves. This fact should be borne in mind when considering the validity of the conclusions drawn by the authors from the comparison of their new expression with Professor Young's values, as these values must include any assumptions made in deducing the thermodynamical formula.

24. "Derivatives of *o*-xylene." (Preliminary note.)

By John Lionel Simonsen.

With the view of devising a new method for the preparation of 3-nitro-*o*-xylene, the author has investigated the nitration of *o*-xylene-4-sulphonic acid. The three isomeric nitro-*o*-xylene-4-sulphonic acids have been isolated, and yield amides melting at 158°, 180°, and 214° respectively.

The acid which yields the amide melting at 158° has been shown to be 4-nitro-*o*-xylene-5-sulphonic acid. Experiments are in progress with a view to orientating the other two nitro-sulphonic acids.

The sulphonation of *o*-3-xylidine and *o*-4-xylidine is also under investigation.

25. "The alkaloids of *Xanthoxylum brachyacanthum*."

By Hooper Albert Dickinson Jowett and Frank Lee Pyman.

The bark of *Xanthoxylum brachyacanthum* was shown to contain 0.06 per cent. of γ -homochelidonine, and a quaternary base, which was isolated in the form of its chloride, $C_{21}H_{24}O_4NCl \cdot H_2O$, in a yield of 1.85 per cent. The properties of this salt suggested that it was one of the methochlorides of *l*-canadine. A quantity of the latter alkaloid was therefore methylated, and the α - and β -methochlorides were separated, when it was found that the former was identical with the salt from *X. brachyacanthum*.

The physiological examination of *l*-canadine α - and β -methochlorides, which was carried out by Dr. P. P. Laidlaw, showed that both possessed a curare-like action, and that the relative activity in this respect was as 1 to 12 on the frog.

26. "The absorption spectra of simple aliphatic substances in solutions and as vapours. Part II. Unsaturated aldehydes and ketones." By John Edward Purvis and Nial Patrick McClelland.

The chief results obtained in the examination of the absorption spectra of certain unsaturated aldehydes and ketones were (1) the

considerable number of narrow bands found in the vapours of acrolein and crotonaldehyde, and which are absent from their solutions; and (2) the absence of similar narrow bands from the vapours of other unsaturated aldehydes, ketones, alcohol, and acid, and the close similarity of their specific absorption with those of the solutions. These results were discussed from a consideration of the ethenoid linking and the carboxyl group acting as primary oscillation centres.

27. "Phytin and phytic acid." (Preliminary note.)

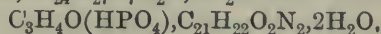
By George Clarke.

Phytin was extracted from finely ground, oil-free seeds of the ordinary Indian field mustards, a mixture of *Brassica juncea* (Hf and T) and *Brassica campestris* (Linn.), by 4 per cent. acetic acid or 0.2 per cent. hydrochloric acid, and separated from the dark brown acid extract by neutralisation with ammonia. The crude substance was purified by further extraction, and precipitation from dilute acetic acid, and finally by extracting with ice-cold 8 per cent. acetic acid, from which it separated on boiling as an amorphous, white powder, completely redissolving if allowed to cool. The yield was 0.3—0.4 per cent. of the seeds.

The phytin thus prepared resembled in properties the substance described by Schulze and Winterstein (*Zeitsch. physiol. Chem.*, 1896, **22**, 90). It was completely soluble in cold, very sparingly so in hot, dilute acetic acid. It was decomposed by heating under pressure at 130—150° with 30 per cent. sulphuric acid into phosphoric acid and inositol (hexa-acetyl derivative, m. p. 211°).

The free acid was obtained from the pure phytin described above by precipitating the lead salt from cold dilute acetic acid, decomposing the latter with hydrogen sulphide, and repeating the treatment until the acid residue was completely soluble in 95 per cent. ethyl alcohol. This substance consisted of a mixture of approximately equal proportions of phosphoric acid and an acid corresponding with the formula $C_3H_4O(HPO_4)$.

The strychnine salt of the above acid, corresponding with the empirical formula, $C_{24}H_{27}O_7N_2P, 2H_2O$ or



crystallised from boiling water, in which it was sparingly soluble, in long needles melting and decomposing at 202—203° (uncorr.). It was very easily separated in a pure condition from strychnine dihydrogen phosphate [m. p. 252—253° (uncorr.)], with which it was mixed, by fractional crystallisation from water, the latter salt being very readily soluble in the cold.

28. "The constituents of the oil of *Cydnus Indicus*."

By Edwin Roy Watson.

The strong and unpleasant odour of the insect *Cydnus Indicus* is due to an oil which it secretes. The oil has been found to contain a large percentage of a non-volatile oil of the same general character as other animal oils. It also contains about 1.5 per cent. of an oil which is volatile with steam. This consists of an acid, $C_8H_{14}O_2$, probably *cycloheptanecarboxylic acid*, and a small quantity of a non-acid substance ($C_{11}H_{20}O_2$?). The acid has a strong, rancid odour, and the non-acid volatile substance has a still stronger odour.

29. "Vapour density of ammonium nitrate." (Preliminary note.)

By Prafulla Chandra Rây and Sarat Chandra Jana.

In continuation of the determination of the vapour density of ammonium nitrite, the authors have extended their work to other decomposable substances under diminished pressure. Ammonium nitrate was selected for the present experiment, and the determination of the vapour density was effected in a modified form of Victor Meyer's apparatus suitable for diminished pressure. It has been found that a part of the salt decomposes into nitrogen monoxide and water, and the rest sublimes. When the tube becomes cold after completion of the experiment, white crystals of the salt were deposited in the neck of the tube. The vapour density was found to be approximately 20. It thus seems probable that the undecomposed part completely dissociates into ammonia and nitric acid in the gaseous state.

30. "The solubility of sulphanilic acid and its hydrates."

By James Charles Philip.

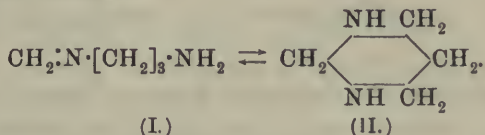
The solubility of sulphanilic acid has been determined at temperatures between 0° and 55° , and the resulting curve exhibits two breaks, corresponding with changes in the character of the solid which is in equilibrium with the saturated solution. The solids which are successively stable in contact with the saturated solution are dihydrate, monohydrate, and anhydrous acid respectively, and the temperatures at which the transitions occur are 21° and 40° .

The dihydrate of sulphanilic acid is an efflorescent substance which loses all its water rapidly and regularly under conditions in which the monohydrate is unchanged, or is dehydrated with extreme slowness. This observation indicates that the water molecules in the dihydrate and in the monohydrate are attached in different ways.

31. "Hexahydropyrimidine and its benzoyl derivatives."

By Arthur Walsh Titherley and Gerald Eyre Kirkwood Branch.

By the action of aqueous formaldehyde on $\alpha\gamma$ -diaminopropane monohydrochloride, a mixture of the hydrochlorides of methylene- $\alpha\gamma$ -diaminopropane (I) and hexahydropyrimidine (II) results, in which the former greatly predominates. On adding alkali the two bases form a tautomeric equilibrium mixture, in which the cyclic form (II) predominates:



On fractionation the cyclic base distils at about 150° , leaving a polymerised form of the open-chain base, but owing to rapid tautomeric change in the distillate, on refractionation it leaves behind a considerable portion as the non-volatile open-chain base. An aqueous solution of the mixture of bases on titration with acid requires rather more than one equivalent to reach the neutral point, but owing to isomerisation to the cyclic form (and partly to hydrolysis, yielding $\alpha\gamma$ -diaminopropane) further gradual addition of acid gives a second neutral point corresponding with two equivalents. Hydrolysis prevents pure crystalline salts being isolated.

The monobenzoyl derivative, $\text{CH}_2\text{:N}\cdot[\text{CH}_2]_3\cdot\text{NHBz}$, obtained by the action of formaldehyde on monobenzoyl- $\alpha\gamma$ -diaminopropane (T., 1912, 101, 2350) is an amorphous ψ -base of neutral reaction, which with hydrochloric acid rearranges, giving the crystalline hydrochloride of monobenzoylhexahydropyrimidine, but the free base cannot be obtained, since it immediately rearranges to the open-chain, amorphous methylene derivative.

1:3-Dibenzoylhexahydropyrimidine is a stable, crystalline solid (m. p. 95°) obtained in quantitative yield by the moist benzoylation of methylene- $\alpha\gamma$ -diaminopropane \rightleftharpoons hexahydropyrimidine, and also by the slow action of formaldehyde on dibenzoyl- $\alpha\gamma$ -diaminopropane in the presence of concentrated hydrochloric acid.

32. "Condensation of ketones with phenols."

By Hemendra Kumar Sen-Gupta.

Methyl ethyl ketone condenses with α -naphthol in glacial acetic acid solution in the presence of fuming hydrochloric acid, yielding the anhydride of 1:1-dihydroxymethylethyl- $\alpha\alpha$ -dinaphthylmethane,

$\text{CMeEt} \langle \text{C}_{10}\text{H}_6 \rangle \text{O}$ (m. p. $154\text{--}155^\circ$); in common with the

members of this type, it crystallises from glacial acetic acid in transparent, rhombic plates. A *bromo*-derivative melts at 250° , and a *nitro*-compound at 265° . Methyl propyl ketone and diethyl ketone condense under the same conditions, giving respectively the *anhydrides* $\text{CMePr} \langle \text{C}_{10}\text{H}_6 \rangle \text{O}$ (m. p. 162°) and $\text{CEt}_2 \langle \text{C}_{10}\text{H}_6 \rangle \text{O}$ (m. p. 166.5°). Acetophenone and α -naphthol, when dissolved in a minimum quantity of glacial acetic acid and saturated with dry hydrogen chloride, condense in the course of five to seven hours at 100° , and the *compound* $\text{CMePh} \langle \text{C}_{10}\text{H}_6 \rangle \text{O}$ melts at 167° . Benzophenone does not appreciably condense in presence of hydrogen chloride alone; phosphoryl chloride, however, brings about the condensation very readily, and the *compound* $\text{CPh}_2 \langle \text{C}_{10}\text{H}_6 \rangle \text{O}$ melts at 273° . With an excess of the agent, the product is probably identical with that described by Clough (T., 1906, **89**, 771).

The condensation of acetone and phenol which has been described by Dianin (*J. Russ. Phys. Chem. Soc.*, 1892, **23**, 488) requires about twenty-four hours' heating to give a yield of 60—65 per cent. It has been found in this connexion that by the use of stannic chloride diluted with one and a-half to two times its volume of chloroform, a 50 per cent. yield can be obtained in the course of a few hours at 40 — 50° .

33. "The reaction between ferric salts and thiosulphates."

By John Theodore Hewitt and Gladys Ruby Mann.

The authors have studied the reduction of solutions of ammonia ferric alum by sodium thiosulphate and of other ferric solutions made up with the alum and potassium thiocyanate, phenol, or acetoacetic ester. The rate at which ammonium ferrisulphate reacts is slower than that shown by ferric chloride; the iron probably forms part of a negative complex.

The reactions measured proved to be all of the fourth order.

34. "Influence of acetylacetone on ionic reactions."

By John Theodore Hewitt and Gladys Ruby Mann.

The action of acetylacetone in hindering the precipitation of ferric phosphate from solutions of ammonia iron alum led to a general examination of the action of this substance on solutions of metallic salts, since other metals besides iron furnish volatile acetylacetonates. Approximately $N/20$ -solutions of various metallic salts were prepared, also solutions containing 12.5 and

17.5 grams of acetylacetone per litre. One volume of salt solution mixed with an equal volume of the solution of the acetylacetone would give a solution in which for 1 atom of metal about $2\frac{1}{2}$ molecules or $3\frac{1}{2}$ molecules of acetylacetone were present according to whether the weaker or the stronger solution were used. The weaker solution was used for salts of bivalent metals, the stronger for the trivalent metals.

Ordinary reagents were then added to see whether or not the presence of acetylacetone inhibited their action.

Silver Nitrate.—Slight cloudiness on adding the acetylacetone: sodium chloride precipitates silver chloride.

Mercurous Nitrate.—Acetylacetone reduces to metal.

Mercuric Chloride.—No visible change on adding acetylacetone: hydrogen sulphide precipitates mercuric sulphide.

Lead Nitrate.—No apparent change: hydrogen sulphide, sodium chloride, potassium chromate, sodium carbonate, and potassium sulphate give the usual precipitates.

Copper Sulphate.—Colour changes from blue to green: hydrogen sulphate, potassium thiocyanate, and sodium hydroxide gave the usual reactions.

Cadmium Sulphate.—No visible change: hydrogen sulphide precipitates cadmium sulphide.

Potash Alum.—No apparent change: sodium hydroxide, sodium hydrogen phosphate, and ammonium hydrogen phosphate give the usual precipitates.

Chromium Sulphate.—No visible change. With ammonia and sodium hydrogen phosphate precipitates are formed on keeping. Ammonium hydrogen phosphate gives no precipitate; the precipitate with sodium hydroxide is soluble in excess of the reagent.

Ferric Alum.—Colour changes to deep red (deeper than thiocyanate) on adding acetylacetone. Ammonia produces a precipitate on keeping for some time. Sodium hydrogen phosphate gives no precipitate in the cold, but the solution is considerably lightened in colour, and a precipitate is produced on boiling. Precipitates are obtained with sodium hydroxide and ammonium hydrogen phosphate.

Zinc Sulphate and Manganese Sulphate.—No visible change: usual reactions with sodium hydrogen phosphate, sodium carbonate, hydrogen sulphide, and sodium hydroxide.

Nickel Sulphate.—No visible change: usual reactions with sodium hydroxide and hydrogen sulphide (after adding ammonia).

Cobalt Sulphate.—No visible change: hydrogen sulphide precipitates cobalt sulphide after adding ammonia. Sodium hydroxide gives a blue precipitate, which turns brown on keeping.

35. "Viscosity and association. Part IV. The viscosity of the aromatic amines." By Ferdinand Bernard Thole.

This work was undertaken with the primary object of finding whether substitution in the benzene ring affects the viscosity of the aromatic amines in the same way as in the case of the phenols.

At the same time the range of amines previously studied by Mussell, Thole, and Dunstan has been increased considerably.

A large number of amines, substituted both in the amino-group and in the benzene nucleus by different groups, have been examined in the pure state at 55° and in amyl acetate solution.

The results show a number of interesting parallels with the corresponding phenolic derivatives, especially as regards the influence of the carbethoxyl and nitro-groups, but frequently the analogies are hidden by the influence of other factors, the important effects of which are shown much more clearly in this series than in the other types of compounds hitherto examined.

36. "The influence of the constitution of tertiary bases on the rate of formation of quaternary ammonium salts. Part I." By Ebenezer Rees Thomas.

The author has measured the reaction-velocities of certain aromatic tertiary bases with allyl bromide, and, in some cases, benzyl bromide, at 40° in *N*/10-absolute alcoholic solution.

Twenty-one bases have been examined, and certain general conclusions as to the influence of the nature and position of substituents were indicated.

37. "Some blue iron cyanogen compounds."

By Herbert Ernest Williams.

The precipitation of a blue ferric ferrocyanide from a ferrocyanide of an alkali metal always contains some alkali metal in combination which cannot be removed by washing. Several blue compounds were prepared under different conditions from the alkali metal ferrocyanides, and analysed after being thoroughly washed and dried.

In all cases the alkali metal was found to be present in definite ratio to the ferrocyanogen, and blue iron cyanogen compounds of complex formulæ were obtained.

Manganomanganic ferrocyanide is produced by the action of concentrated nitric acid on the white manganous ferrocyanide; it forms a dark brown, granular powder.

38. "Some properties of carbon monoxide."

By Richard William Merriman.

Three hundred litres of carbon monoxide were prepared by slowly delivering pure formic acid below the surface of concentrated sulphuric acid kept at 60°. The gas was passed through four Drechsel flasks containing 30 per cent. sodium hydroxide, and was collected over water in a large gas-holder. Although always described as an odourless and tasteless gas, this specimen had a perfectly definite metallic odour and taste. The idea occurred to the author that it might contain a small quantity of the unknown formic anhydride. This substance would have the properties of an aldehyde, so the following experiment was performed. The gas was bubbled through a series of Drechsel flasks containing the following solutions: sodium hydroxide, decolorised rosaniline, sodium hydroxide (2), Fehling's solution, and ammoniacal silver nitrate. The decolorised rosaniline was not altered, but the silver nitrate and Fehling's solution were at once reduced.

Carbon monoxide prepared in the following ways also possessed similar properties.

(a) *From Oxalic Acid*.—Two hundred and thirty c.c. of pure sulphuric acid were added to 100 grams of crystallised oxalic acid. The temperature rose to 45°. Effervescence commenced at 65°, and slow evolution at 90°. A regular stream of gas was evolved by keeping the temperature at 110°. The gas was washed with four portions of 30 per cent. sodium hydroxide and passed through four soda-lime towers. It was passed through three Drechsel flasks containing Fehling's solution and three containing ammoniacal silver nitrate. All showed reduction.

(b) *From Potassium Cyanide*.—Pure sulphuric acid was dropped on to 200 grams of potassium cyanide in lumps. The cyanide turned brown, and rapidly evolved gas. The gas was passed through four Drechsel flasks containing 30 per cent. sodium hydroxide, four soda-lime towers, and two Drechsel flasks containing 20 per cent. silver nitrate. The first two portions of sodium hydroxide turned reddish-brown and finally black. The last silver nitrate showed no precipitate of silver cyanide. The gas possessed the same odour, taste, and reducing properties as the other specimens.

(c) *From Pure Sulphuric Acid and Sodium Formate*.—External heat was unnecessary except at the end of the preparation. The gas was washed as before, and had the same properties.

(d) *From 70 per Cent. Sulphuric Acid and Sodium Formate*.—The formate dissolved at 70°; slow evolution of gas commenced at

85°, but did not become rapid below 115°; the final temperature was 135°. The gas, treated as before, possessed the same properties.

(e) Smaller quantities of gas were prepared from lactic acid and malic acid with similar results.

(f) *From Carbon Dioxide and Carbon.*—As a final test, 40 litres of carbon monoxide were prepared by slowly passing pure carbon dioxide through a tube 80 cm. long packed with charcoal heated to bright redness. In this experiment formic anhydride could not have been produced. The carbon dioxide from a Kipp's apparatus was passed through two wash-bottles containing sodium carbonate solution and two containing pure sulphuric acid. The resulting gas was washed as before, and possessed the same properties.

It follows that pure carbon monoxide possesses a perfectly characteristic odour and taste, and readily reduces Fehling's solution and ammoniacal silver nitrate solution. It has no action on decolorised rosaniline.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Barnett, Edward de Barry. The preparation of organic compounds. London 1912. pp. xvi + 310. ill. 8s. 6d. net. (*Recd.* 14/1/13.)

From the Author.

Cross, Charles Frederick, and Bevan, Edward John. Researches on cellulose. III (1905-1910). London 1912. pp. x + 173. 7s. 6d. net. (*Recd.* 7/1/13.)

From the Authors.

II. *By Purchase.*

Richter, Victor von. Chemie der Kohlenstoffverbindungen oder organische Chemie. Vol. II. Carbocyclische und heterocyclische Verbindungen. Edited by R. Anschütz and H. Meerwein. 11th edition. Bonn 1913. pp. xxii + 1048. M. 26.—. (*Reference.*)

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Metropole, at 7 for 7.30 o'clock, on Friday, March 14th, 1913 (the day fixed for the Annual General Meeting).

The Council has decided to invite Fellows to become Stewards for this Dinner, the additional liability of each Steward not to exceed 10s. 6d.

The price of the tickets will be One Guinea each, including wine, and half a guinea each, not including wine. All applications for tickets must be received not later than Friday, March 7th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to Mr. S. E. Carr, and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

At the next Ordinary Scientific Meeting on Thursday, February 20th, 1913, at 8.30 p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"The mode of combustion of carbon." By T. F. E. Rhead and R. V. Wheeler.

"The nomenclature of the rhamnase group and of other substances related to the aldohexoses." By H. Marshall.

"Some green iron cyanogen compounds." By H. E. Williams.

"Catalytic decomposition of hydrogen peroxide." By Gwen Dyer and Alice B. Dale.

CERTIFICATES OF CANDIDATES FOR ELECTION
AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 20th, 1913.

Acland, Theodore William Gull,

19, Bryanston Sq., W., and King's College, Cambridge.

Student. I have been working as a Science Student for some years. Last year I took Natural Sciences Tripos, Part I. This year I am studying Chemistry only, doing the work for Part II. in that subject.

W. J. Sell.

W. H. Mills.

J. G. M. Dunlop.

C. T. Heycock.

W. J. Pope.

Sydney Lupton.

Adam, Neil Kensington,

21, Barton Road, Cambridge.

Scholar of Trinity College, Cambridge. Student of Chemistry in the University Laboratory, Cambridge: 1st Class Natural Sciences Tripos, Part I.

W. J. Pope.

C. T. Heycock.

F. G. Hopkins.

H. J. H. Fenton.

W. J. Sell.

W. H. Mills.

Beath, William,

152, St. George's Road, Hull.

Teacher of Chemistry at the Boulevard Secondary School, Hull. Intermediate B.Sc. Exam., Lond. Univ. I am desirous of keeping in touch with all the recent work in connexion with the study of Chemistry, in order to fit me for my post of “Teacher of Chemistry.”

F. W. De Velling.

Harry Thompson.

T. Luxton.

R. J. Porter.

T. A. Nightscales.

Bissett, Crellyn Colgrave,

10, Claremont Place, Sheffield.

Student. B.Sc. (London), Chemistry being one of the subjects. B.Met. (Sheffield), with Honours. At present Honours Student in Chemistry at Sheffield University.

W. Palmer Wynne.

J. Kenner.

W. E. S. Turner.

W. J. Jarrard.

C. R. Young.

Brier, Albert,

19, Alexander Road, Ulverston, Lancs.

M.Sc. (Chemistry), Leeds University. B.Sc. (Chemistry and Physics), Victoria University. Senior Science Master, Ulverston Victoria Grammar School, and Lecturer in Chemistry, Ulverston Evening School.

Arthur Smithells.

H. M. Dawson.

J. B. Cohen.

G. H. Daniel.

W. Meredith.

Burr, Percy Charles,

Essex Lodge, Ravensbourne Park, Catford, S.E.

Teacher of Science. Obtained First Class Honours in Chemistry at London B.Sc., 1912. Has studied Chemistry during the last three years at the Goldsmiths' College, New Cross; desires to undertake Chemical Research.

Arthur Lapworth.

R. W. L. Clarke.

George Barger.

Geo. Jas. Woods.

Arthur J. Ewins.

Christie, John Hugh,

c/o Dr. Bean, Crossgates, Near Leeds.

Pupil of the Leeds City Analyst. B.Sc. (Lond.), Honours in Chemistry (2nd Class). Formerly a schoolmaster (taught mathematics and science). At present a pupil of T. Fairley, Esq., Public Analyst, Leeds.

Arthur Smithells.

B. A. Burrell.

J. B. Cohen.

Thomas Fairley.

H. M. Dawson.

F. G. Harmer.

Clotworthy, Harold Reginald Septimus,

39, Trinity College, Dublin, Ireland.

Research Assistant to W. H. Thompson, Sc.D., Professor of Physiology, Trinity College, Dublin. I received my training in the Chemical Laboratories of the Royal College of Science for Ireland and

Trinity College, Dublin, and I have the following degrees: B.A. (T.C.D.), B.Sc. (Lond.), A.R.C.Sc.I.

Emil A. Werner.

Wm. Caldwell.

Hans Krall.

Arthur Wallace.

Sydney Young.

Cockshutt, John Albert, M.Sc.,

Senior Science Master, Queen's College, Taunton, Somerset. B.Sc. with Honours in Chemistry, Manchester University, 1911; M.Sc. by Research, 1912.

Harold B. Dixon.

Ch. Weizmann.

Gilbert J. Fowler.

E. C. Edgar.

W. H. Perkin.

Cutbush, Charles George,

59, Byne Road, Sydenham, Kent.

Chief Assistant of Testing at the City of London Electric Light Co.'s Power Works, Bankside. For 8 years past in charge of Chemical Laboratory at above works; 16 years with Company as Testing Assistant. Student at Regent Street Polytechnic (2 years Evening Courses); student at Borough Polytechnic (3 years Evening Courses).

F. Mollwo Perkin.

H. Burrows.

Charles A. Keane.

M. C. Lamb.

Walter Hibbert.

Davies, Daniel James,

177, Le Marchant Road, St. John's, Newfoundland.

Vice-Principal, Methodist College, St. John's. Analyst to the Depart. of Agriculture and Mines, Newfoundland. B.Sc. (Wales) in Chemistry, Metallurgy and Assaying, Geology. July, 1904—May, 1905, Assistant Analyst and Assayer to Messrs. Edwd. Riley & Co., 14A, Finsbury Square, London, E.C. Taught Chemistry, Sept., 1903—July, 1904, Whitland County School. May, 1905—Sept., 1905, Demonstrator in Chemistry, Swindon Education Committee. Sept., 1905—July, 1911, taught Chemistry, Llandyssul Intermediate School.

A. A. Read.

Claude M. Thompson.

E. P. Perman.

Edwd. Riley.

Robt. D. Abell.

Doumin, Roland,

76, Tannsfeld Road, Sydenham, S.E.

After receiving a general classical and scientific education at school, I was for some time in the laboratories of Messrs. Jeaneard Fils, and under M. Satie, where I received a thorough training in the Chemistry and Technology of Essential Oils. I am desirous of

keeping in touch with modern research on the subject, and am anxious to have the benefit of the Society's publications.

John C. Umney.

Edgar Neumann.

Edwin Harrison.

Hubert E. Burgess.

Ernest J. Parry.

Edmondson, James Henry,
93, Manchester Road, Bolton.

Chief Assistant to the Manager and Chemist, Bolton Corporation Sewage Works. Passed through a course of Evening Lectures and Laboratory Work in Pure and Applied Chemistry, Physics, &c. (period 5 years), at Manchester Technical School. Engaged in varied analytical work, and research on the Purification of Sewage, under Dr. Fowler, F.I.C., at the Manchester Sewage Works, for a period of seven years.

Edmund Knecht.

Jas. Grant.

F. S. Sinnatt.

F. G. Richards.

W. E. Speight.

S. J. Peachey.

Elliott, Thomas Lenton,
Lincoln House, Heckmondwike, Yorks.

Technical Chemist (Textile Industries). Formerly Senior Assistant to Messrs. Cannon and Newton, Analysts and Assayers, and Consulting Chemists of Mincing Lane and Love Lane, London, E.C. (Business now discontinued). The Candidate is well known amongst Naturalists' Societies in the West Riding of Yorks as a lecturer on biological chemistry and on applications of chemical science to questions of Natural History in general. The Candidate chiefly desires election to regularly receive the publications of the Society.

R. S. Cabill.

R. T. Marshall.

C. E. Womersley.

A. G. Green.

H. R. Cooper.

Evans, Ulick Richardson,
The Keir, The Common, Wimbledon.

Consulting Electrochemist at 28 Victoria Street, Westminster. Cambridge University Natural Science Tripos, Part I, First Class Honours; Part II., Second Class.

Samuel Rideal.

C. T. Heycock.

W. J. Pope.

W. H. Mills.

F. W. Dootson.

Garrett, Albert Edward,

"Yaverland," Clarence Road, St. Albans, Herts.

Analyst and Scientific Adviser to the Dr. Jaeger Sanitary Woollen System Co., Ltd., 95, Milton Street, E.C. B.Sc. (by Research) Lond. Author of: *Periodic Law*, "International Scientific Series; *Advance of Photography*, Kegan Paul & Co.; *Fibres for Fabrics*, Hodder and Stoughton. Original papers read at Physical Society of London: (1) "Chemical Decomposition and Electrical Conductivity"; (2) "Electrical Conductivity Produced by Heating Salts"; (3) "Effect of Radiations on the Brush Discharge"; (4) "Positive Electricity Produced by Heating Salts."

Isaac Sydney Scarf.

George W. Neal.

E. J. Jackman.

J. Lewkowitsch.

Edward Gardner.

Ghose, Tin Kari,

23/1 Baniatola Street, Hatkhola P.O., Calcutta.

Assistant Analyst, Calcutta Corporation. (1) B.A. (Calcutta University); (2) L.M.S. (Calcutta Medical College); (3) Assistant Analyst, Calcutta Corporation—Analysis of water, food and drugs is done here; (4) Consulting Chemist to B. K. Paul & Co.'s Research Laboratory, where preparations of indigenous drugs are manufactured.

T. N. Majumdar.

Dhirendanath Mitra.

S. N. De.

David Hooper.

G. D. Hope.

Gilmour, Robert, B.Sc., Ph.D.,

Scores Villa West, St. Andrews.

Carnegie Research Fellow. Graduated B.Sc., 1908, St. Andrews University. Papers with Prof. J. C. Irvine: "Constitution of Glucose Derivatives," Parts I and II., *J.C.S.*, 1908, 93, 1429, and 1909, 95, 1545. 1909–11, studied at Würzburg; 1912, Ph.D. Würzburg.

Thomas Purdie

William S. Denham.

J. C. Irvine.

W. N. Haworth.

J. L. A. Macdonald.

Gray, George Watson,

8, Inner Temple, Liverpool.

Analytical and Consulting Chemist. Fellow of the Institute of Chemistry. Author of papers relating to Chemical Analysis.

J. E. Stead.

F. W. Harbord.

Boverton Redwood.

H. A. Auden.

Robert Redwood.

James Smith.

Henville, Douglas,

67, Glencoe Street, Newington, Hull, Yorks.

Analyst. Associate of the Institute of Chemistry. Lecturer in Technical Chemistry at the Hull Municipal Technical College. Two years in the laboratory of R. A. Cripps, Esq., F.I.C., Brighton. Two years and a-half at University College, Nottingham. Three months as locum tenens, to lecture in Dairy Chemistry and carry out agricultural analyses, at the Midland Agricultural and Dairy College, Kingston, Derby. Three years and a-half as assistant analyst and bacteriologist at the City Laboratories, Hull.

Arnold R. Tankard

Geo. H. Appleyard.

John Evans

G. E. Scott-Smith.

Jas. T. Stevenson.

Hewitt, James Arthur, B.Sc. (St. Andrews),

3, South Bridge Street, St. Andrews, Fife.

Assistant to the Professor of Physiology, the University, St. Andrews, Fife. As my teaching and research work include physiological chemistry, I am desirous of keeping in touch with the Society's work and publications.

J. C. Irvine.

Thomas Purdie.

William S. Denham.

G. Druce Lander.

W. N. Haworth.

Holt, William Joseph,

31, Spruce Hills Road, Walthamstow.

Teaching. Interested in chemistry, and desire to keep up to date in the subject.

J. T. Hewitt.

W. H. Ratcliffe.

Clarence Smith.

A. D. Mitchell.

Frank G. Pope.

Arthur E. Pitt.

Howells, Alfred Leslie,

"Bank Field," New Mill Road, Holmfirth, West Riding, Yorkshire.

Assistant Schoolmaster. B.Sc. (London), First Class Honours in Chemistry at Final (October, 1910); South Kensington Honoursman in Chemistry (1910); Drapers' Science Scholar, East London College (University of London), September, 1907, to July, 1910. Science Master in the Secondary School, Holmfirth, Yorkshire. Lecturer on Chemistry in the Holmfirth Technical Institute (September, 1911, to the present time).

J. T. Hewitt.

Clarence Smith.

Frank G. Pope.

J. J. Fox.

Arthur E. Pitt.

Kirkland, Thomas James, B.Sc.,
Hereward Hall, Ely, Cambridgeshire.

First Science Master, King's School, Ely. Educated at Westminster School and King's College, London. Since January, 1906, have been First Science Master at King's School, Ely. In addition to teaching work have been engaged in Analytical work connected with the Printing Industry.

John M. Thomson.

Herbert Jackson.

Patrick H. Kirkaldy.

B. Middleditch.

Henry L. Smith.

Leitch, Peter Thomas,

c/o John Edgar, Esq., 176, West George Street, Glasgow.

Assistant to R. R. Tatlock & Thomson, Public Analysts, Glasgow, from August, 1905, to February, 1911. Student at the West of Scotland Technical College, Glasgow, for Iron and Steel, Assaying and General Chemistry. Sometime Assistant to the Canada Cement Co., Limited, at Plant No. 2, Montreal, Que., and Plant No. 12, Exshan, Alberta. At present, Chief Chemist at Plant No. 12, Exshan, Alberta.

R. R. Tatlock.

Harry Dunlop.

R. T. Thomson.

G. G. Henderson.

Thomas Gray.

Lloyd, Daniel William,

The Manse, Ormonde Road, Kilkenny.

Senior Instructor in Science and Mathematics, City Technical School, Kilkenny. B.Sc., University of London. Senior Demonstrator in Chemistry and Physics, etc., Technical School, Kilkenny. Consulting Analyst for the St. Francis' Abbey Brewery, Kilkenny. Analyst for the Woollen Mills, Kilkenny, in 1909. Analyst for Motor Factory, Patrick Street, Kilkenny, 1910.

J. Woodward.

Beresford Ingram.

E. Towyn Jones.

J. H. Robbins.

Robt. D. Abell.

J. W. Shepherd.

John Evans.

A. E. Middleton.

Loynes, Walter Cyril,

Eastfield, Comberton Road, Kidderminster.

Analytical Chemist to Messrs. J. P. Harvey & Co., Ltd., Chemical Manure Manufacturers, etc., and Assistant to Joseph Lones, F.I.C., F.C.S. I have had five years' experience in analytical work in metallurgy, fertilisers and feeding stuffs, and for the last two and a-half years in food and drugs in the Laboratory of the Public Analyst for

Smethwick. Of late years I have devoted considerable time to the study of electricity in its relation to chemical science. I have also had a great deal of experience in the analysis of waters and sewage.

Cecil Duncan.

Ernest J. Parry.

J. Stewart Remington.

Chas. J. Waterfall.

Arthur Adams.

Fredk. O'Brien.

Macbeth, Alexander Killen, M.A., B.Sc.,

3, Victoria Terrace, Cregagh, Belfast.

Demonstrator in Chemistry. Senior Scholar in Chemistry, 1911-12. Andrews Student, 1912. First Class Honours in M.A. (Q.U.B.); First Class B.Sc. (gold medal), Q.U.B. Appointed Senior Demonstrator in Chemistry, Queen's University, Belfast, 1912. Has contributed to Proceedings and Transactions of the Society.

E. A. Letts.

C. R. Crymble.

Samuel Smiles.

A. W. Stewart.

R. Wright.

Martin, Henry Stephen,

64, Dyke Road, Brighton, Sussex.

Pharmacist, M.P.S. I received my early training as a student in an analytical laboratory; engaged for the past thirty-five years in the manufacturing and dispensing of all kinds of pharmaceutical compounds. Greatly interested, and have conducted investigations, in the manufacturing of mineral and aerated waters. For knowledge, have been awarded Gold, Silver, and Bronze Medals, also three Diplomas, and three Certificates of Honour and Merit, and still continue my researches as a chemist.

Chas. Umney.

C. T. Bennett.

John C. Umney.

William Stevenson.

Arthur W. Crossley.

Maude, Aylmer Henry,

Great Baddow, nr. Chelmsford.

Chemist. I studied Chemistry at Finsbury Technical College, obtained their Certificate, studied an additional two years and obtained the Associateship of the Institute of Chemistry. I have worked as Assistant Chemist to Mr. M. J. Cannon and to Messrs. S. Courtauld & Co.

Matthew J. Cannon.

Arthur J. Hale.

Sidney S. Napper.

G. Francis Morrell.

R. Meldola.

May, Joseph Horsnell,

21, Donovan Avenue, Muswell Hill, N.

Electro-chemical Engineer. Member Institution Electrical Engineers. Chief Chemist and Laboratory Superintendent from 1893 to 1910; Chief Chemist and Works Superintendent, 1910; Chief Engineer (with control of all chemical and technical work), 1911—Electrical Power Storage Company, Ltd., Storage Battery Manufacturers. Consulting Chemical Engineer, 1912-13.

Walter A. Voss.

John J. Pilley.

E. R. Buggé.

Spencer Pickering.

Arthur F. Strohmenger.

Mumford, Ernest Joseph,

67, Hatherley Road, Walthamstow, N.E.

Teacher. Made a special study of Chemistry. I wish to keep up to date in the subject.

J. T. Hewitt.

Clarence Smith.

Frank G. Pope.

A. D. Mitchell.

Arthur E. Pitt.

Murphy, Paul,

Burnside, Sidcup, Kent.

Analyst. Studied Chemistry at the City and Guilds Technical College, Finsbury, under Professor Meldola for four years, taking full course and obtaining the Diploma on leaving. Fellow of the Institute of Chemistry. Assistant to Dr. Bernard Dyer, of 17, Great Tower Street, E.C.

Raphael Meldola.

J. F. H. Gilbard.

Bernard Dyer.

Frank W. G. King.

B. H. Buttle.

Naylor, Jonathan Harold,

73, Castle Street, Bolton, Lancashire.

Senior Chemistry Master, Secondary School, Widnes, 1912. First Assistant, Chemistry Department, Mining and Technical College, Wigan, 1907—1912. Have passed through the 3 years' course in the Honours School of Chemistry, at Manchester University, and one year's research work. Obtained the degrees of B.Sc. (Honours in Chemistry) and M.Sc. Obtained the Associateship of the Institute of Chemistry, 1912.

Harold B. Dixon.

Ch. Weizmann.

W. H. Perkin.

Norman Smith.

E. B. Naylor.

Nolan, Thomas Joseph,
32, Newmarket, Dublin.

Research Student. M.Sc. with First Class Honours, National University; Travelling Student in Chemistry of the National University. Demonstrator in Chemistry at University College, Dublin, and joint author of papers published in the *Proceedings* of the Royal Irish Academy and in the *Proceedings* of the Chemical Society.

William Ramsay.

Samuel Smiles.

J. Norman Collie.

N. T. M. Wilsmore.

W. C. McC. Lewis.

Pollard, Cornelius Theodore,

21, Wharnccliffe Road, Broomhall Park, Sheffield.

Student. B.Sc. (Sheffield), Chemistry being one of the subjects. At present, student for M.Sc. (Chemistry) at Sheffield University.

W. Palmer Wynne.

J. Kenner.

W. E. S. Turner.

W. J. Jarrard.

C. R. Young.

Rae, William Norman,

Colombo, Ceylon.

Lecturer in Science, Royal College, Colombo. Corpus Christi College, Cambridge, 1905-8; Second Class Honours, Part I., Nat. Science Tripos, Camb., 1908. Science Master, Cranbrook School, Kent, 1908-11. Science Lecturer, Royal College, Colombo, 1911.

A. F. Joseph.

K. C. Browning.

Thomas Cockerill.

M. Kelway Bamber.

A. Bruce.

Roskin, Hermann Horace,

11, Newlands Road, Middlesbrough.

Assistant Science Master, Middlesbrough High School; Lecturer in Chemistry, Middlesbrough Evening Technical School. B.Sc. (Wales): subjects—the Metallurgical group (Inorganic Chemistry, Metallurgy, and Geology). Distinctions in Advanced Chemistry at the Central Welsh Board Senior Examination. Seven years' experience as Teacher and Lecturer of Theoretical and Practical Chemistry (appointments other than above being: Assistant Science Master, County School, Ebbw Vale, Mon., and Senior Science Master at the Grammar School, Wotton-under-Edge, Glos.).

R. B. Wight.

H. Frankland.

J. E. Stead.

Ernest W. Jackson.

C. H. Ridsdale.

Simpson, William Slessor,

Dynamite Factory, Somerset West, South Africa.

Analytical and Research Chemist, Cape Explosives Works, Somerset West, South Africa. M.A. (Abdn.); B.Sc. (Abdn.), with special distinction in Chemistry and Geology. For eight years (1904-12) an Assistant Research Chemist in the Research Department, Royal Arsenal, Woolwich.

F. R. Japp.

Robert Robertson.

William Ramsay.

Alfred C. G. Egerton.

W. H. Gibson.

Smith, John Walter,

48(A), Hurstbourne Road, Forest Hill, S.E.

Teacher in London County Council service. Obtained 2nd Class Honours in Chemistry at London B.Sc., 1912; has worked for the last four years at Goldsmiths' College, New Cross, and now desires to undertake chemical research.

Arthur Lapworth.

R. W. L. Clarke.

George Barger.

Geo. Jas. Woods.

Arthur J. Ewins.

Taylor, Harold Victor,

Royal College of Science, London.

At present Student (adv. work); Chemistry Lecturer (1907-1910) at Hurst Grammar School, Taunton; Chemistry Student (1910-1912) at R.C.S. (London); Degree in Chemistry, A.R.C.S. Research work (1912): "Enzymes of the Pitcher fluid of the *Nepenthes* plant."

H. F. Harwood.

M. O. Forster.

James C. Philip.

H. Brereton Baker.

Chapman Jones.

Thompson, Percy James,

The Avenue, Clytha Square, Newport, Mon.

Student of Agricultural Chemistry; sometime Lecturer in Analytical Chemistry. 1906-7, Student of Pharmaceutical Chemistry at Metropolitan College of Pharmacy, London; 1907-8, Student at Bath and West of England College of Chemistry and Pharmacy; 1908-11, Lecturer at the latter college—engaged with D. J. Williams, F.C.S., Ph.C., in analysis of foodstuffs, sewage, etc.; 1912, specialising in Agricultural Chemistry; Student at the Summer School of the Royal Agricultural College, Cirencester (passing the examination in Agricultural Chemistry); Silver Medallist in Chemistry and Pharmacy;

Qualified as Pharmacist and Member of the Pharmaceutical Society.
Desirous of keeping abreast of modern research.

David J. Williams.	<i>D. L. Chapman.</i>
John M. H. Munro.	<i>B. Lambert.</i>
J. Griffin.	<i>M. P. Applebey.</i>

Turner, Bertrand,

55, Golden Hillock Road, Birmingham.

Research Student, University of Birmingham. Passed final examinations for B.Sc. (Birmingham). Chemistry Principal.

Percy F. Frankland.	Edward P. Frankland.
Hamilton McCombie.	C. K. Tinkler.
J. E. Coates.	Frederick Challenger.

Turnill, Thomas Willoughby,

Stibbington, Wansford, Northamptonshire.

Chemist and Works' Manager. Pupil of W. Elborne, M.A., Public Analyst, Peterboro'; then Assistant Chemist, Hull Stearine Co.; Chemist and Departmental Manager at Messrs. Major, Tar Distillers, Hull; Manager and Chemist at Works at Stoke Ferry, Norfolk, manuf. sulphate of ammonia from peat. Two years Chief Assistant to J. A. Foster, F.I.C., Public Analyst, E.R. Yorks., etc., and at present am Chemist and Works Manager at Atlas Preservative Co., Deptford, S.E.

Thos. Luxton.	Ambat Kesava Menon.
Edwin B. Atkinson.	<i>T. P. Parkes.</i>

C. E. Cooke.

Webb, Edward,

Berwyn, Totteridge, Herts.

Lecturer (Chemistry), Islington L.C.C. Training College, Offord Road, Barnsbury, N. B.Sc. (London). Chemistry Lecturer (6 years) Islington Training College (L.C.C.). Formerly Science Master Finsbury (L.C.C.) Pupil Teachers' Centre (9 years).

George W. Neal.	Jos. S. Bridges.
James Swain.	<i>Frank E. Weston.</i>

H. R. Ellis.

Wilson, Siddons Siddons,

154, Burges Road, East Ham.

Analytical Chemist to The British Oil and Cake Mills, Ltd., 29, Great St. Helens, E.C. Assistant Chemist in The British Oil and Cake Mills laboratory for ten years.

J. Lewkowitsch.	A. E. Dunstan.
F. B. Thole.	R. W. Wilson.

A. J. Harvey.

Wood, Hubert Rogers,

c/o Messrs. Fenner & Alder & Co., Ltd., Millwall, E.

Works Chemist. Three years pupil to Mr. Harry Thompson, F.C.S., Hull. Two years Chief Assistant Chemist at the Hull Stearine and Warehousing Co., Ltd., Hull. One and a-half years Assistant Chemist at Blundell Spence & Co., Ltd., Hull. Four years (and present situation) Chief Chemist at Fenner & Alder & Co., Ltd., Paint Manufacturers, London. Desire to be admitted as a Fellow of the Society for the use of Journal and Library as a great help in my study and general analytical and chemical work.

Harry Thompson.

Arnold R. Tankard.

Geo. H. Appleyard.

T. Luxton.

Thos. A. Nightscales.

The following Certificate has been authorised by the Council for presentation to ballot under Bye-law I(3) :

Parker, Jonathan,

c/o The Wattle Extract Co., 42, Anglo-African House, Durban,
S. Africa.

Analytical Chemist. Junior Assistant to Dr. Hellon, Public Analyst, Whitehaven. Chemist to the St. Helens Colliery Co. Workington, and in charge of the Chemical Department of the Bye-Products Recovery Plant. Held similar post with the Moresby Coal Co. Chemist to the Wattle Extract Co., Durban, Natal.

Robert Hellon.

W. H. Watson.

Henry R. Procter.

J. Tcherniac.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29.

No. 411.

Thursday, February 20th, 1913, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society through death of:

	Elected.	Died.
Otis Coe Johnson	March 4th, 1897	June 6th, 1912
Theodore David Lichtenstein	February 21st, 1879	October 23rd, 1912
George Matthey	May 3rd, 1870	February, 14th, 1912
B. Venkata Rao	December 7th, 1911	1912

Certificates were read for the first time in favour of Messrs.:

Horace George Battye, 28, Roman Place, Roundhay, Leeds.

Noël Guilbert Stevenson Coppin, M.Sc., Rydal Mount, Runcorn, Cheshire.

Harold Davies, 18, Windsor Road, Ilford.

Fritz Haber, Post Lichterfelde, 3, Berlin-Dahlem.

Darab Dinsha Kanza, M.A., Indian Institute of Science, Bangalore.

Emmanuel F. Kur, Learansa, Devonshire Road, St. Anne's-on-Sea.

Bhaichand Anupchand Mehta, M.A., Indian Institute of Science, Bangalore.

Francis Martin Potter, B.Sc., 6, Stavordale Road, Highbury, N.

Arthur Samuel Robinson, B.Sc., King's School, Pontefract.

Reginald William Rusby, Westgate, Greenhill Road, Moseley, Birmingham.

Hormusji Kharshedji Sahiar, M.A., Indian Institute of Science,
Bangalore.

William James Stansfield, 12, Bell Hatt Terrace, Savile Park,
Halifax.

A Certificate has been authorised by the Council under
Bye-law I(3) in favour of:

Ferrand Paget, Bombay Burma Trading Corporation, Ltd.,
Bangkok, Siam.

The following announcements were made:

(1) That the following changes in the Officers and Council were
proposed by the Council:

President to retire.—Prof. Percy F. Frankland.

Secretary to retire.—Prof. Arthur W. Crossley.

Foreign Secretary to retire.—Dr. Horace T. Brown.

Vice-Presidents to retire.—Dr. M. O. Forster and Prof. A.
Liversidge.

Ordinary Members of Council to retire.—Prof. W. A. Bone, Mr.
A. R. Ling, Dr. A. McKenzie, and Dr. J. C. Philip.

As President.—Prof. W. H. Perkin.

As Vice-Presidents who have filled the office of President.—Prof.
H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir
James Dewar, Prof. H. B. Dixon, Prof. Percy F. Frankland, Dr.
A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof.
W. Odling, Sir William Ramsay, Prof. J. Emerson Reynolds, The
Right Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir
William A. Tilden.

As Treasurer.—Dr. Alexander Scott.

As Hon. Secretaries.—Dr. Samuel Smiles and Dr. J. C. Philip.

As Foreign Secretary.—Prof. Arthur W. Crossley.

As Vice-Presidents.—Prof. H. B. Baker, Dr. G. T. Beilby, Dr.
Horace T. Brown, Prof. E. J. Mills, Prof. G. T. Morgan, and Prof.
W. Jackson Pope.

As New Ordinary Members of Council.—Dr. G. Barger, Mr. E. J.
Bevan, Prof. F. G. Donnan, and Prof. K. J. P. Orton.

(2) That Fellows were invited to attend a meeting of the
Faraday Society to be held in the rooms of the Chemical Society
on Wednesday, March 12th, from 4 to 6 and 8 to 10 p.m., when
a discussion on "Colloids and their Viscosity" would take place.

Prof. J. Millar Thomson, Dr. Samuel Rideal, and Prof. J. J.
Dobbie were elected Auditors to audit the Society's Accounts.

A ballot for the election of Fellows was held, and the following were subsequently declared elected:

Theodore William Gull Acland.	Peter Thomas Leitch.
Neil Kensington Adam, B.A.	Daniel William Lloyd, B.Sc.
William Beath.	Walter Cyril Loynes.
Crellyn Colgrave Bissett, B.Sc.	Alexander Killen Macbeth, M.A., B.Sc.
Albert Brier, M.Sc.	Henry Stephen Martin.
Percy Charles Burr, B.Sc.	Aylmer Henry Maude.
John Hugh Christie, B.Sc.	Joseph Horsnell May.
Harold Reginald Septimus Clotworthy, B.A., B.Sc.	Ernest Joseph Mumford.
John Albert Cockshutt, M.Sc.	Paul Murphy.
Charles George Cutbush.	Jonathan Harold Naylor, M.Sc.
Daniel James Davies, B.Sc.	Thomas Joseph Nolan, M.Sc.
Roland Doumin.	Jonathan Parker.
James Henry Edmondson.	Cornelius Theodore Pollard, B.Sc.
Thomas Lenton Elliott.	William Norman Rae, B.A.
Ulick Richardson Evans, B.A.	Hermann Horace Roskin, B.Sc.
Albert Edward Garrett, B.Sc.	William Slessor Simpson, M.A., B.Sc.
Tin Kari Ghose, B.A., L.M.S.	John Walter Smith, B.Sc.
Robert Gilmour, B.Sc., Ph.D.	Harold Victor Taylor.
George Watson Gray.	Percy James Thompson.
Douglas Henville.	Bertrand Turner, B.Sc.
James Arthur Hewitt, B.Sc.	Thomas Willoughby Turnill.
William Joseph Holt.	Edward Webb, B.Sc.
Alfred Leslie Howells, B.Sc.	Siddons Siddons Wilson.
Thomas James Kirkland, B.Sc.	Hubert Rogers Wood.

Of the following papers, those marked * were read:

***39. "The mode of combustion of carbon."**

By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

The authors, in continuation of their work on the combustion of carbon, whereby they showed that carbon dioxide and carbon monoxide are produced together when carbon is burned, described experiments made to account for this simultaneous production of the two oxides.

It was shown that carbon, at all temperatures up to 900° and probably above that temperature, has the power of pertinaciously retaining oxygen. This oxygen cannot be removed by exhaustion alone, but only by increasing the temperature of the carbon during exhaustion. When quickly released in this manner, it appears, not as oxygen, but as carbon dioxide and carbon monoxide. The proportions in which it appears in these two oxides when completely removed depends on the temperature at which the carbon has been heated during oxygen-fixation.

It was shown also that no physical explanation alone can account

for this "fixation" of oxygen, but that, in all probability, it is the outcome of a physico-chemical attraction between oxygen and carbon. Physical, inasmuch as it seems hardly possible to assign any definite molecular formula to the complex formed, which indeed exhibits progressive variation in composition; chemical, in that no isolation of the complex can be effected by physical means.

Decomposition of the complex by heat produces carbon dioxide and carbon monoxide. At a given temperature of decomposition these oxides make their appearance in a given ratio. Further, when a rapid stream of air at a given temperature is passed over carbon (which has previously been saturated with oxygen at that temperature), carbon dioxide and carbon monoxide appear in the products of combustion in nearly the same ratio as they do in the products of decomposition of the complex at that temperature.

It is therefore suggested that the first product of combustion of carbon is a loosely-formed physico-chemical complex, which can be regarded as an unstable compound of carbon and oxygen of an at present unknown formula, C_xO_y . It is probable that no definite formula can be assigned to this complex.

DISCUSSION.

Professor SMITHELLS, after commending the previous paper by the same authors for its new observations and as a lucid and trustworthy account of the history of the controverted question of the combustion of solid carbon, said that he saw no *prima facie* objection to the doctrine of C_xO_y .

The case of the combustion of solid carbon was essentially different from that of carbon in gaseous compounds. In that case observations on the rate of explosion of cyanogen mixed with different proportions of oxygen, and analysis of the gases in the flame of cyanogen, as well as spectroscopic evidence, pointed to carbon monoxide as the first product. The argument relating to the more likely co-operation of two molecules rather than three, $C_2N_2 + O_2$ rather than $C_2N_2 + 2O_2$, as the first transaction in a molecular system, was not applicable to the case of solid carbon. The molecule of solid carbon, judging from the very high volatilisation temperature of the element, was probably of great atomic complexity, and it could easily be believed that such an atomic complex in the stationary position of the solid state, rained upon by a shower of oxygen molecules, could, at a moderate temperature, result in the production of C_xO_y , where x and y might be very high numbers. The complex, of course, at a higher temperature would be resolved into the proportions of CO and CO_2 conformable to the equilibrium

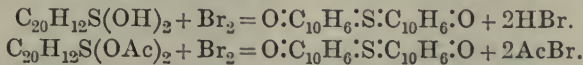
at that temperature of the system: solid carbon, carbon monoxide, carbon dioxide.

Professor DONNAN asked what period of time the authors waited after pumping off the gases in order to determine the final pressure of carbon monoxide and carbon dioxide in equilibrium with the assumed complex C_xO_y . As the carbon monoxide and dioxide were produced initially *in* the adsorbed layer or in the solid carbon, the establishment of equilibrium might take some time.

Professor BONE, replying on behalf of the authors, said that the point raised by Professor Donnan was dealt with in the paper; the authors' evidence for the formation of the complex C_xO_y was largely cumulative, and could only be judged by a detailed study of the experimental work as a whole. Speaking personally, he had still an open mind on the subject, although, like Professor Smithells, he had no *a priori* difficulty in accepting the idea of the primary formation of the said complex. With regard to the President's remarks about the probable cause of the spontaneous combustion of coal, he thought that it might be attributed to the oxidation of the constituents extractable by pyridine, which decomposed on heating below 700° , yielding chiefly paraffin hydrocarbons and little hydrogen (see Burgess and Wheeler's papers on "The Volatile Constituents of Coal"), and which were probably derived from the resinous matter in the vegetable debris from which the coal originated.

***40. "The interaction of bromine and the sulphides of β -naphthol. Part II." By Thomas Joseph Nolan and Samuel Smiles.**

The diacetyl derivative of the unstable sulphide was converted into the anhydride by treatment with boiling acetic anhydride and sodium acetate. This anhydride—termed *isonaphthathioxin*—was found to be different from that obtained by dehydrating the stable sulphide. With bromine it yielded a dibromonaphthathioxin, which was identical with the product formed by the interaction of this halogen and the acetyl derivative of the unstable sulphide. Previous experiments (T., 1912, 101, 1420) had shown that with bromine this sulphide yields the dibromosulphonium-quinone, and it was concluded that the different result now obtained with the acetyl derivative is due to liberation of acetyl bromide at a preliminary stage of the interaction, the two cases being represented as follows:



Independent experiment proved that in the presence of acetyl

bromide and bromine the sulphonium-quinone yields the dibromonaphthathioxin.

The diacetyl derivative of the stable sulphide did not react with bromine under the conditions chosen in these experiments.

It was also pointed out that the properties of the hydroxyl groups in the unstable sulphide correspond with those of an unsaturated tertiary alcohol.

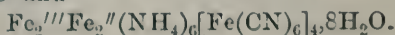
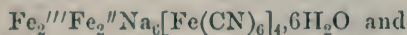
41 "The nomenclature of the rhamnose group and of other substances related to the aldohexoses." By Hugh Marshall.

In view of the definite establishment, by E. Fischer and K. Zach (*Ber.*, 1912, **45**, 3761), of the configuration of "rhamnose" and "isorhamnose," the author suggested the adoption of a systematic nomenclature for the group, based on that of the aldohexose group, so as to avoid the multiplication of novel names and the use of prefixes "*iso*," etc. It was proposed that the name *rhamnose* should be used for the whole isomeric group, and be prefixed by the stem of the name of the aldose having the same configuration; the individual names would then be:—(*d*- and *l*-) *mannorhamnose* (ordinary rhamnose), *glucorhamnose* (*isorhamnose* or *isorhodeose*), *idorhamnose*, *gulorhamnose*, *galactorhamnose*, *talorhamnose*, *alloorhamnose*, *altrorhamnose*. It was also suggested that a similar principle should be applied in the case of other hexose derivatives which would have eight pairs of stereoisomerides; at least, to those containing any two different terminal groups out of the following four: CO_2H , CHO , $\text{CH}_2\cdot\text{OH}$, CH_3 , such as the isomerides of glucuronic acid.

42. "Some green iron cyanogen compounds."

By Herbert Ernest Williams.

A solution of ammonium ferrocyanide when boiled in contact with the air, forms a dull green deposit, which has the formula $\text{Fe}_2^{III}\text{Fe}^{II}(\text{NH}_4)_8[\text{Fe}^{II}(\text{CN})_6]_4, 3\text{H}_2\text{O}$; a similar potassium compound, $\text{Fe}_2^{III}\text{Fe}^{II}\text{K}_8[\text{Fe}^{II}(\text{CN})_6]_4, 6\text{H}_2\text{O}$, is produced by adding very dilute hydrochloric acid gradually to a boiling solution of potassium ferrocyanide, and by substituting ammonium chloride solution for the hydrochloric acid the compound $\text{Fe}_2^{III}\text{Fe}^{II}(\text{NH}_4)_7\text{K}[\text{Fe}(\text{CN})_6]_4, 3\text{H}_2\text{O}$ is produced. Somewhat similar compounds of ferrosiferrous ferrocyanides of a dull blue colour were prepared, agreeing with the formulæ:

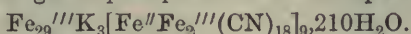


These compounds can be considered as molecular compounds of the ferric double salts and ferrous ferrocyanides, as in the case of the blue iron cyanogen compounds.

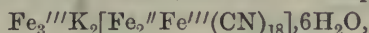
Ferric ferrocyanide when boiled with concentrated nitric acid is converted into the green compound, $\text{Fe}_7'''[\text{Fe}''\text{Fe}'''(\text{CN})_{12}]_3, 54\text{H}_2\text{O}$.

By boiling ferric potassium ferrocyanide with nitric acid a green compound, $\text{Fe}_{13}'''[\text{Fe}''\text{Fe}_3'''(\text{CN})_{24}]_3, 100\text{H}_2\text{O}$, is obtained; this compound is also produced by passing chlorine through freshly precipitated ferric ferrocyanide.

The addition of ferric salts to a solution containing one equivalent of ferrocyanide and more than three equivalents of ferricyanide yields a fine dark green precipitate of the composition:

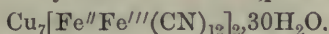


When ferrous potassium ferrocyanide, obtained by distilling potassium ferrocyanide with dilute acid, is oxidised whilst still boiling with excess of nitric acid, the violet compound,



is produced.

Cupric ferrocyanide when boiled with concentrated nitric acid also yields a ferroferricyanide of the composition

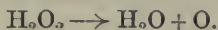


From a consideration of the formation of these green compounds, and particularly of the copper compound, it is probable that they are ferric ferroferricyanides, and not ferrosoferric ferricyanides.

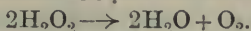
43. "Catalytic decomposition of hydrogen peroxide."

By Gwen Dyer and Alice Barbara Dale.

It has been generally accepted on the authority of Bredig and Müller von Berneck (*Zeitsch. physikal. Chem.*, 1900, **31**, 289) that the catalytic decomposition of hydrogen peroxide in aqueous solution proceeds as a unimolecular reaction:



Bredig's observations seem to have been made with solutions of about 0.0007 gram of hydrogen peroxide per c.c. The present authors find that in a solution containing 0.0025 gram of hydrogen peroxide per c.c. the action appears to be a bimolecular one:



Fifty c.c. of the solution were kept at constant temperature of 20° , 2 c.c. of Bredig's colloidal platinum solution being added as a catalyst. Successive quantities of 5 c.c. were titrated with potassium permanganate at exactly noted intervals, varying from five to ten minutes.

Taking $C_1, C_2, C_3 \dots$ as the volumes of permanganate required after intervals of $t_1, t_2, t_3 \dots$ minutes, the values of K were calculated in accordance with each of the following equations:

(1). $K = \frac{1}{t_2 - t_1} \cdot \log \frac{C_1}{C_2} = \frac{1}{t_3 - t_2} \cdot \log \frac{C_2}{C_3}$, etc., for a reaction of the first order.

(2). $K = \frac{1}{t_2 - t_1} \cdot \frac{C_1 - C_2}{C_1 C_2} = \frac{1}{t_3 - t_2} \cdot \frac{C_2 - C_3}{C_2 C_3}$, etc., for a reaction of the second order.

K (1).	K (2).
0.005877	0.001547
0.004389	0.001558
0.005123	0.001621
0.003980	0.001793
0.005006	0.001675
0.004592	0.001793

The discrepancy between the successive values of K shown in the first column, and the comparative constancy of the values calculated in the second column, appear to indicate a bimolecular reaction.

44. "The decomposition of hydrogen peroxide by colloidal platinum." By Harold Llewelyn Bassett.

Bredig investigated the decomposition of hydrogen peroxide by colloidal platinum, and found the change to be unimolecular (Bredig and Müller, *Zeitsch. physikal. Chem.*, 1900, **31**, 258). In subsequent discussions of the mechanism of the decomposition, Senter and Sand accept Bredig's result as to the order of the reaction, and the point seems to have been assumed to be finally settled (*Proc. Roy. Soc.*, 1904, **74**, 356, 566). The experiments were repeated by Miss Dyer and Miss Dale (see preceding abstract), but it was noticed that very poor unimolecular constants were usually obtained, and the results often corresponded more closely with a bimolecular change.

It appeared of interest to investigate the cause of these apparent anomalies, and it was found that the order of the reaction depends entirely on the concentration of the hydrogen peroxide. Bredig and others worked with solutions of about 1/50 gram-molecular weight per litre, or even greater dilution than this, and at these dilutions the decomposition certainly is unimolecular. On increasing the concentration, however, the reaction slowly becomes bimolecular, and bimolecular constants are obtained at a concentration of about 1/9 gram-molecular weight per litre. After this, increase of concentration does not affect the order of the reaction,

but owing to the rapid evolution of oxygen the experimental difficulties in obtaining constants become very great.

Nernst suggests that in such cases as these the velocity measured is not that of the chemical change, but simply that of the diffusion of the solute to the surface of the particles of colloidal metal. He assumes that equilibrium is at once set up when this surface is reached.

Senter and Sand discuss this hypothesis and the importance of the part played by convection in the liquid. Their results suggest that the hypothesis, if at all true, will have to be considerably modified to account for the observed values for the velocity constants. It is assumed all through these papers that decomposition of the hydrogen peroxide actually takes place when the molecules come into contact with the surface of the platinum.

This would account for the action being unimolecular, but it is difficult to see how a bimolecular change can be explained in this way. A single molecule would break up when it reached the surface of the platinum, and this decomposition would have no connexion with that of other molecules.

To account for the bimolecular change in stronger solutions it is now suggested that, as the concentration increases, hydrogen peroxide molecules meet in the film of solute surrounding the platinum particles without ever reaching the surface of the platinum, and are decomposed in this surface film by contact with one another, possibly owing to the influence of surface tension.

The opportunity for this would clearly be greater in stronger solutions, and with steadily increasing concentration it would gradually become the more important decomposition. Finally, in solutions giving a bimolecular constant, it is practically the only one taking place. Further increase of concentration, whilst increasing the amount decomposed, would have no effect on the order of the reaction, in agreement with experiment. The bimolecular decomposition depends on the presence of at least two hydrogen peroxide molecules in a given small space at the same time, and this will clearly depend only on the concentration of the hydrogen peroxide, and will not be affected by the amount of platinum present.

This view as to the change in the character of the decomposition with increase of concentration appears to explain satisfactorily all the experimental facts observed.

In carrying out the experiments slightly acid hydrogen peroxide was used, the presence of acid having been shown by Bredig not to affect the course of the decomposition. Solutions of the various strengths were made up and placed in a thermostat at 25°. When

the solutions had reached the temperature of the bath, 2 c.c. of colloidal platinum solution were added to 100 c.c. of the hydrogen peroxide solution. These proportions were used in all the experiments.

Titration were made on 5 or 10 c.c. of the solution at intervals of five or ten minutes, according to the strength of the hydrogen peroxide. Potassium permanganate was used of strengths to give convenient titrations in the various cases. An attempt was made to estimate the hydrogen peroxide by potassium iodide in excess of sulphuric acid, but it was unsuccessful owing to the length of time required to complete the reaction with the hydriodic acid. With the stronger hydrogen peroxide solutions, great difficulty was experienced owing to the rapid evolution of bubbles of oxygen in the pipette, making accurate measurement very difficult.

The figures at the heads of the columns below give the strengths of the hydrogen peroxide in gram-molecules per litre.

The constants are calculated with ordinary logarithms as their actual magnitudes are not discussed, and as different strengths of permanganate were used, the bimolecular-constant values are not comparable, and are only to be considered as regards their constancy.

Unimolecular Constants.

0.0034.	0.0141.	0.0208.	0.107.	0.119.	0.145.	0.205.
0.014	0.022	0.021	0.013	0.0043	0.0075	0.0083
0.016	0.024	0.023	0.012	0.0041	0.0068	0.0066
0.015	0.022	0.020	0.011	0.0040	0.0062	0.0072
0.013	0.019	0.018	0.010	0.0032	0.0057	0.0071
0.015	0.017	0.017	0.008	0.0036	0.0051	0.0053
0.015	0.015	0.015	0.008	0.0035	0.0054	0.0057

Bimolecular Constants.

0.0034.	0.0141.	0.0208.	0.107.	0.119.	0.145.	0.205.
0.0036	0.0029	0.0027	0.0016	0.0050	0.0015	0.0012
0.0047	0.0042	0.0038	0.0019	0.0049	0.0015	0.0011
0.0048	0.0049	0.0042	0.0022	0.0051	0.0015	0.0013
0.0052	0.0057	0.0048	0.0021	0.0046	0.0015	0.0013
0.0073	0.0061	0.0056	0.0020	0.0046	0.0014	0.0011
0.0090	0.0082	0.0058	0.0023	0.0050	0.0016	0.0012

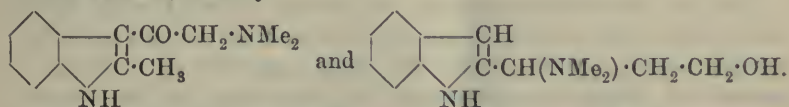
45. "The absorption spectra of substances containing labile hydrogen atoms." By Peter Joseph Brannigan, Alexander Killen Macbeth, and Alfred Walter Stewart.

An examination of various compounds containing a displaceable hydrogen atom showed that they may be divided into two classes: (a) those which, whilst showing only general absorption in alcoholic solution, give rise to a banded absorption in presence of alkali; and

(b) those which do not conform to this rule, even when the sodium derivative can be isolated. With regard to the first class of compounds it has been found that several derivatives of malonic acid develop bands the penetration of which is dependent on the amount of alkali present in the solution. This confirms Hantzsch's observations on ethyl acetoacetate. The bands are evidently due to the presence of the sodium derivatives of the various substances, and have nothing to do with the tautomeric changes assumed by Baly and Desch to explain their existence. To explain the difference between the spectra of the enolic form and the sodium salt, Hantzsch's suggestion of internal complex salt formation may be accepted, or an alternative one based on Gebhard's views on affinity may be employed. In either case it seems that if a band is to be produced by the sodium salt the sodium atom must come into the 1:5- or 1:6-position with regard to a carbonyl group, as the sodium derivative of urethane shows no band in its spectrum. A similar explanation can be put forward to account for the presence of the band in the spectrum of ethyl β -aminocrotonate.

46. "Researches on the constitution of physostigmine. Part II. The synthesis of 3-dimethylaminoacetyl-2-methylindole and 2- α -dimethylamino- γ -hydroxypropylindole." By Arthur Henry Salway.

The author described the synthesis of two indole derivatives containing an aliphatic side-chain, which is oxygenated, and possesses a tertiary basic nitrogen atom, in combination with the indole nucleus, namely:



These substances were prepared for the purpose of comparing their properties with those of eseroline, $\text{C}_{13}\text{H}_{18}\text{ON}_2$, which has previously been shown (T., 1912, 101, 988) to contain, in all probability, an indole complex.

As a result of the investigation it is concluded that eseroline is not a simple indole compound containing an open side-chain.

47. "Contributions to our knowledge of semicarbazones. Part II. The semicarbazones of mesityl oxide." By Forsyth James Wilson and Isidor Morris Heilbron.

A semicarbazone of mesityl oxide (α -semicarbazone) melting at 164° has been prepared by Scholtz (*Ber.*, 1896, 29, 612), and further

investigated by Harries and Kaiser (*Ber.*, 1899, **32**, 1338). The authors find that this α -semicarbazone when exposed in chloroform solution to ultraviolet light is partly converted into a stereoisomeride (β -form) melting at 133—134°, the difference between the two forms being due to nitrogen isomerism in the sense of the Hantzsch-Werner hypothesis. The differences between the four semicarbazones of phenyl styryl ketone previously studied by the authors (T., 1912, **101**, 1482) is due to nitrogen stereoisomerism combined with carbon stereoisomerism, whilst in the present case carbon stereoisomerism is excluded. The two modifications give practically identical absorption spectra, which are not affected by alkali; also, they undergo no change of colour in light. In order that absorption may be affected by alkali and phototropy be evident, the authors conclude that carbon and nitrogen stereoisomerism are both necessary.

The α -semicarbazone on distillation yielded a substance melting at 129°, which is probably cyclic in structure (Scholtz, Harries, and Kaiser, *loc. cit.*). The same compound can be obtained by distilling the β -semicarbazone, a transformation of the β - into the α -form first taking place.

On exposure in chloroform solution to ultraviolet light both modifications are partly converted into one another, an equilibrium between the two forms being established.

48. "Oxidation of the nitro-*o*-xylenes with dilute nitric acid."

By Charles Horne Warner.

The two mononitro-*o*-xylenes are readily oxidised with dilute nitric acid, giving in almost quantitative amount the corresponding nitrophthalic acids (T., 1909, **95**, 207). In view of this fact it seemed of interest to investigate the behaviour of this reagent towards the di- and tri-nitro-*o*-xylenes, especially since some of the nitrophthalic acids which it was hoped to obtain were required for comparison with substances resulting from other reactions. The oxidations do not, however, proceed smoothly; the nitrophthalic acids are only obtained in small amounts, and the products are not easily isolated in a pure condition.

When 3:5-dinitro-*o*-xylene (*ibid.*, p. 209) was oxidised with dilute nitric acid in sealed tubes, it yielded a liquid and a solid product. On evaporation, the former gave 3:5-dinitro-*o*-phthalic acid (compare Merz and Weith, *Ber.*, 1882, **15**, 2708), which could not be completely purified by crystallisation alone, but was obtained, melting at 225°, through its monoethyl ester (Beilstein and Kurbatov, *Annalen*, 1880, **202**, 227). The acid crystallises from

water saturated with hydrogen chloride in long, thin, flattened needles. The *diethyl* ester, obtained by heating the silver salt in a dry benzene solution of ethyl iodide, separates from alcohol in fine, colourless needles, melting at 73°. The *anhydride* was prepared by heating the acid with excess of acetyl chloride. It crystallises from a mixture of ethyl acetate and light petroleum (b. p. 40—60°) in stout, colourless needles, melting at 161°. Water very readily reconverts it into the acid, exposure to laboratory air being sufficient to effect this change.

From the solid product mentioned above there was isolated 3:5-dinitro-*o*-toluic acid melting at 206° (compare Jacobsen and Wierss, *Ber.*, 1883, 16, 1959).

3:4-Dinitro-*o*-phthalic acid was obtained by the oxidation of the corresponding dinitro-*o*-xylene with dilute nitric acid. It separates from concentrated hydrochloric acid in small, colourless needles, melting and evolving gas at 204—205°. The *diethyl* ester, prepared through the silver salt, crystallises from alcohol in colourless needles melting at 69°.

3:4-Dinitro-*o*-toluic acid, which is produced in the above reaction, crystallises from a mixture of ethyl acetate and light petroleum (b. p. 40—60°) in stout, colourless needles, melting at 182°. The *diethyl* ester was prepared from the silver salt of the acid; it separates from alcohol in colourless, rectangular plates, melting at 63°.

Both 3:4:5-trinitro- and 3:4:6-trinitro-*o*-xylene appear to be completely decomposed when heated with dilute nitric acid in sealed tubes.

49. "Phosphonium and ammonium iodides."

By Alfred Holt and James Eckersley Myers.

Phosphonium iodide vapour decomposes on heating when it is dry, rendering the purification of this substance by sublimation extremely difficult.

The substance appears to be unchanged when sublimed in the presence of traces of water vapour.

The behaviour of ammonium iodide under similar conditions was described as a comparison.

50. "The phosphoric acids and some phosphates."

By Alfred Holt and James Eckersley Myers.

Experiments with two polymeric forms of metaphosphoric acid were described, and it was shown that the hydration of the mono-variety is unimolecular.

Experiments with glacial phosphoric acid lead to the belief that its vapour does not have a composition corresponding with the formula HPO_3 .

Examination of the metaphosphates of the alkalis failed to give evidence that they are derived from acids other than mono- and tri-metaphosphoric acids.

51. "Optical activity and enantiomorphism of molecular and crystal structure." By Thomas Vipond Barker and James Ernest Marsh.

It was pointed out that no molecular configuration is enantiomorphous unless it is devoid of all the following three elements of symmetry—plane, centre, and alternating axis. Enantiomorphism is, however, compatible with the presence of ordinary axes of symmetry, so that an enantiomorphous structure is not necessarily asymmetric, that is, totally devoid of symmetry.

The discussion of the conditions necessary for optical activity in the liquid and crystalline states leads to the conclusion that the optical activity of crystals of magnesium sulphate, monohydrated sodium dihydrogen phosphate, Schlippe's salt, sodium uranyl acetate, sodium chlorate, and sodium bromate cannot be referred to a spiral arrangement of the molecules in the crystal edifice, which arrangement is possible in quartz, cinnabar, and others, but must be due to the same cause as the optical activity in crystals of sucrose, namely, an enantiomorphous configuration of the molecule. Enantiomorphous constitutions developed on lines of co-ordination were proposed for the six substances in question. The inactive character of the solutions was attributed to auto-racemisation.

52. "Some double salts with acetone of crystallisation and the crystallisation of silver iodide, silver bromide, and cuprous iodide." By James Ernest Marsh and W. C. Rhymes.

The iodides of silver, lead, and copper form double salts with the alkali metal iodides, which are readily soluble in acetone. Many of these salts crystallise well on evaporation of the acetone in dry air. The rubidium silver salt has the composition $\text{RbI}, 2\text{AgI}, 2\text{C}_3\text{H}_6\text{O}$, the potassium salt $\text{KI}, 2\text{AgI}, 2\text{C}_3\text{H}_6\text{O}$, and the ammonium salt, which crystallises in a different form, $\text{NH}_4\text{I}, 2\text{AgI}, 3\text{C}_3\text{H}_6\text{O}$. These salts lose acetone readily on exposure to air. The potassium salt slowly deliquesces, and ultimately crystals of silver iodide are deposited from the solution thus formed.

If lithium iodide and silver iodide in the proportion of LiI to 2AgI are dissolved in acetone and the solution is exposed to the air, no double salt separates, but large, transparent crystals of silver

iodide gradually form. Silver bromide has been obtained well crystallised from solution in lithium bromide and acetone. Crystalline cuprous iodide has also been obtained from solution in lithium iodide and acetone.

53. "The relation between the absorption spectra of acids and their salts." By Robert Wright.

An examination of the absorption spectra in aqueous solutions of a number of acids and their sodium salts seems to justify the following conclusions: (1) There is not of necessity a relation between absorptive power and degree of ionisation, for many feeble acids show the same spectra as their highly ionised salts. (2) Although change of absorptive power on salt formation may in some cases be due to a difference in the structures of the acid and its salt, still many acids show spectra different from those of their salts, even when such change of structure in the molecule is hardly possible.

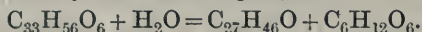
54. "Synthetical experiments in the group of the *isoquinoline* alkaloids. Part III. The constitution of anhydrocotarnine-acetophenone, etc., together with an account of some new condensation products of cotarnine." By Edward Hope and Robert Robinson.

The authors have submitted to a careful examination the condensation products of cotarnine with acetophenone and ethyl phenylacetate, which were first described by Liebermann and his co-workers (*Ber.*, 1904, **37**, 211), and regarded by them as derivatives of *N*-methylaminoethylbenzaldehyde. It is now found that these substances are in reality derivatives of tetrahydro*isoquinoline*, and are therefore constituted analogously to narcotine and hydrastine. New condensation products of a similar nature have been prepared by the condensation of cotarnine with phenylacetonitrile, 1-hydrindone, 1:3-diketohydrindene, indene, isatin, fluorene, and 1-methylindole.

55. "The identification of ipuranol and some allied compounds as phytosterol glucosides." By Frederick Belding Power and Arthur Henry Salway.

It has previously been recorded in connexion with the description of ipuranol and some allied compounds to which distinctive names and formulæ had been assigned, such as citrullol, trifolianol, ipurganol, bryonol, cluytianol, etc., that they yield colour reactions very similar to those given by the phytosterols. The observation

has now been made that several of these compounds, when heated under suitable conditions with aqueous hydrogen chloride, undergo hydrolysis, with the formation of a phytosterol and dextrose. The formula originally assigned to ipuranol, namely, $C_{23}H_{40}O_4$, requires $C=72.6$; $H=10.5$, whereas a sitosterol glucoside, $C_{33}H_{56}O_6$, requires $C=72.3$; $H=10.2$ per cent., and the latter figures are likewise in excellent agreement with the analytical results recorded for ipuranol and some allied compounds. The hydrolysis of ipuranol may therefore be represented by the following equation:



It is concluded that all the compounds of the type of ipuranol are glucosidic in character, although the phytosterols obtained by their hydrolysis are not in all cases identical. In place of the distinctive names which have previously been assigned to a number of these substances, it is proposed to designate them collectively as *phytosterolins*.

ANNIVERSARY DINNER.

It has been arranged that the Fellows of the Society and their friends shall dine together at the Whitehall Rooms, Hotel Metropole, at 7 for 7.30 o'clock, on Friday, March 14th, 1913 (the day fixed for the Annual General Meeting).

The Council has decided to invite Fellows to become Stewards for this Dinner, the additional liability of each Steward not to exceed 10s. 6d.

The price of the tickets will be One Guinea each, including wine, and half a guinea each, not including wine. All applications for tickets must be received not later than Friday, March 7th, next.

Tickets will be forwarded to Fellows on receipt of a remittance for the number required, made payable to Mr. S. E. Carr, and addressed to the Assistant Secretary, Chemical Society, Burlington House, W.

The next Ordinary Scientific Meeting will be held on Thursday, March 6th, 1913, at 8.30 p.m., when the following paper will be communicated:

"Quinonoid salts of nitroanilines." By A. G. Green and F. M. Rowe.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 29

No. 412.

Thursday, March 6th, 1913, at 8.30 p.m., Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

The President referred to the loss sustained by the Society through death on February 19th of Prof. William Tate, of Sibpur, who was elected a Fellow of the Society on May 15th, 1890.

Certificates were read for the first time in favour of Messrs.:

Alfred Gilbert Dix, B.Sc., 110, Tufnell Park Road, Holloway, N.
Percy Wolmer Hill, 42, Holyhead Road, Wednesbury.

Thomas Arthur Holroyd, B.Sc., Carnbuck Club, Perambur Barracks, Madras.

John Francis McCann, 2, Prince of Wales Terrace, Sandymount Avenue, Ballsbridge, Co. Dublin.

Harry Bertram Maynard, The Park, Kingswood, Bristol.

Kali Prosonuo Rai, M.A., 147, Baranoshee Ghose Street, Calcutta.

The following Certificates have been authorised by the Council for presentation to ballot under Bye-law I(3) in favour of Messrs.:

Herbert Garland, Helouan, Cairo.

Julien Pierre Frédéric Pougnet, Natal Estates, Ltd., Mt. Edgecombe, Natal.

Thomas Watson, 1186, Davie Street, Vancouver, B.C.

Of the following papers, those marked * were read:

*56. "Quinonoid salts of nitroanilines."

By Arthur George Green and Frederick Maurice Rowe.

With the object of isolating quinonoid salts of nitroamines (compare T., 1912, 101, 2452), the authors have subjected solutions of various nitroamines in dry benzene to the action of sodium ethoxide. Deep orange to red precipitates were obtained with the following compounds: *o*-nitroaniline, *p*-nitroaniline, *p*-nitroethylaniline, 2:4'-dinitroaniline, 2:4:6-trinitroaniline (picramide), 2-nitro-*p*-toluidine, 6-nitro-*m*-toluidine, 4-nitro-*m*-toluidine, 4-chloro-2-nitroaniline, 3-chloro-2-nitroaniline, 3-chloro-4-nitroaniline, 2-nitro-*p*-phenylenediamine, 2-nitro-4-acetyl-*p*-phenylenediamine. The following nitroamines gave no precipitates, and exhibited no change of colour: *m*-nitroaniline, 5-nitro-*o*-toluidine, 3-nitro-*o*-toluidine, 5-nitro-*o*-4-xylylidine, and also the *o*-, *m*-, and *p*-nitro-derivatives of dimethylaniline.

It would therefore appear that all primary and secondary ortho- and para-nitroamines give rise to deeply coloured quinonoid salts under the conditions employed, but that no such reaction occurs in the meta-series. Analysis of the products supports the general formula $X \leq \begin{smallmatrix} \text{NH} \\ \text{NO}_2 \end{smallmatrix} \text{Na}$. In the case of *p*-nitroaniline, two "chromo-isomeric" salts were obtained, namely, a red labile form and an orange stable form.

The tendency of nitroamines to form quinonoid salts is further exemplified by the properties of nitro-*p*-phenylenediamine. This compound crystallises from water in bluish-red needles, with a dark green reflex, but dissolves in non-ionising solvents with a yellow colour. In the solid state and in its aqueous and alcoholic solutions, which are red, it probably possesses the constitution of an internal quinonoid salt, $\text{NH}_3 \cdot \text{C}_6\text{H}_3 \leq \begin{smallmatrix} \text{NH} \\ \text{NO}_2 \end{smallmatrix}$.

DISCUSSION.

Dr. J. T. HEWITT welcomed the sharp distinction between the *o*- and *p*-nitroanilines on the one hand, and *m*-nitroaniline on the other, since *m*-nitrophenol was not so different from *o*- and *p*-nitrophenols in its chemical nature as might be expected; thus the two latter compounds were not reduced to azoxyphenols by sodium methoxide, neither, however, was *m*-nitrophenol.

*57. "The existence of racemic compounds in the liquid state."

By Alec Duncan Mitchell and Clarence Smith.

The method of determining the molecular weight of a pure liquid by the change of its molecular surface energy with temperature has been applied to the problem of the existence of racemic compounds in the liquid state. Since experience has shown that liquid hydrocarbons and esters usually are unassociated, the substances examined are the active and the inactive modifications of pinene and of limonene, and the dimethyl esters of *d*-tartaric and racemic acids.

The apparatus described by Hewitt and Winmill (T., 1907, 91, 441) has been used, and all measurements of length have been made with a vernier microscope reading directly to 0.01 mm., and by means of a micrometer eye-piece to 0.001 mm.

The values of *k* for *d*-, *l*-, and *i*-pinene (the last being obtained in two different ways) are 2.36, 2.32, 2.36, and 2.33 respectively, the figures in each case being the mean of four values obtained over a range of about 80°. The values of *k* for *d*- and *l*-limonene and dipentene (the last obtained in two ways) are 2.34, 2.23, 2.29, and 2.26 respectively. Dimethyl *d*-tartrate and racemate respectively give the values 1.99 and 2.03 for *k*.

The results indicate that the substances examined do not, in the optically inactive form, exist as liquid racemates.

DISCUSSION.

Mr. F. B. TNOLE pointed out that there was considerable evidence for the existence of liquid dimethyl racemate to a certain extent.

The viscosities of the active and inactive esters were undoubtedly slightly different, whilst Bruni by cryoscopic measurements in ethylene dibromide solution had found indications of the formation of a racemic complex.

The authors appeared to lay particular stress on the absence of variation of *K* with increasing temperature as indicating the absence of association, for *K* altered considerably with temperature in the case of associated liquids, such as water, acetic acid, and alcohol.

It was questionable, however, whether the molecular complexes present in these liquids were really comparable with racemic compounds. The component molecules of the latter were probably much more firmly united than those forming the complexes in the ordinary "associated" liquids, and the variation of *K* with temperature would naturally be much smaller when the complexes were comparatively stable.

***58. "The vapour pressures of the lower alcohols and their azeotropic mixtures with water. Part I. Ethyl alcohol." By Richard William Merriman.**

Quick lime made from marble was found to be the most efficient drying agent for ethyl alcohol. The density of dry alcohol, determined by the method recently described (Wade and Merriman, T., 1912, **101**, 2429) was found to be $0.80628 \text{ } ^\circ\text{O}/4^\circ$. The alcohol, at 100° , has the power of partly dehydrating calcium hydroxide, so that the last fraction in the preparation of dry alcohol should be rejected.

The vapour pressures above 14° were determined by distilling the dry alcohol through an eight-section Young evaporator column, keeping the pressure constant by means of a manostat (Wade and Merriman, T., 1911, **99**, 984). Below 14° another method was used, but the distillation method is the best method for determining vapour pressures if a cold room is available for the lower temperatures. The view was expressed that experimental results should be smoothed by the method of differences, and not by the use of an empirical formula. The results obtained agree closely with those of Schmidt (*Zeitsch. physikal. Chem.*, 1891, **8**, 620). The boiling point is $78.30^\circ/760 \text{ mm.}$, agreeing with Young's value. Ramsay and Young's values (*Phil. Trans.*, 1886, **177**, i, 155) for the vapour pressures below 30° were shown to be somewhat inaccurate, but on being smoothed became almost identical with the results obtained by the author.

The vapour-pressure curves of ethyl acetate (Wade and Merriman, T., 1912, **101**, 2438) and ethyl alcohol cut each other at a point corresponding with a pressure of 948.1 mm. and a temperature of 84.01° .

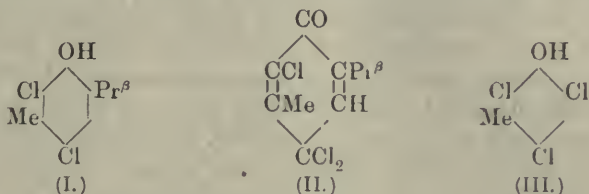
The boiling points of the azeotropic mixtures with water were determined, and compared with the boiling points of the pure alcohol. The differences between the two series of boiling points increases with the pressure, as also does the percentage of water.

***59. "The action of chlorine on thymol and on *m*-cresol." By Horace Leslie Crowther and Hamilton McCombie.**

The authors have investigated the action of chlorine under different conditions and in the presence of various catalysts on thymol and on *m*-cresol.

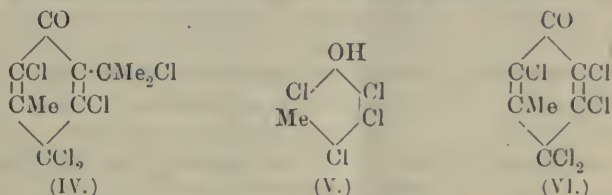
When solid thymol was chlorinated the products obtained were 2:6-dichlorothymol (I) and 2:4:4-trichloro-3-methyl-6-isopropyl-hexadienone (II). The former compound has been described by Blum (*Zeitsch. physiol. Chem.*, 1892, **16**, 518) and the latter by

Lallemande (*Ann. Chim. Phys.*, 1857, [iii], **49**, 148), but this author describes it as trichlorothymol. The constitution assigned to it is justified by its liberating iodine from potassium iodide with the formation of 2:6-dichlorothymol and the non-formation of acyl



derivatives. With sulphuric acid at 100° this compound yields 2:4:6-trichloro-*m*-cresol (III).

When thymol is chlorinated in carbon tetrachloride in the presence of iodine there is formed a small quantity of 2:4:4:5-tetrachloro-3-methyl-6- β -chloroisopropylhexadienone (IV). This constitution is assigned to the substance because it liberates iodine from potassium iodide, does not form acyl derivatives, and with sulphuric acid yields tetrachloro-*m*-cresol (V). It was, however, very difficult



to arrest the chlorination at this stage, and the main products of the reaction were tetrachloro-*m*-cresol (V) and 2:4:4:5:6-pentachloro-3-methylhexadienone (VI). In addition there was formed a small quantity of 2:4:5-trichlorotoluquinone.

Chlorination of thymol in the presence of reduced iron gave rise to 2:4:6-trichloro-*m*-cresol (III), tetrachloro-*m*-cresol (V), and a small quantity of trichlorotoluquinone. Very similar results were obtained when aluminium-mercury was employed as the catalyst.

m-Cresol when chlorinated yielded 2:4:6-trichloro-*m*-cresol, tetrachloro-*m*-cresol, and 2:4:4:5:6-pentachloro-3-methylhexadienone.

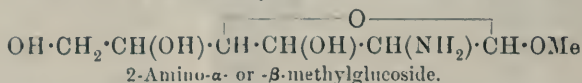
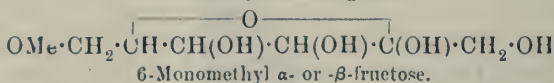
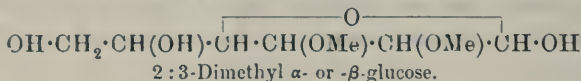
60. "The nomenclature of sugar derivatives."

By James Colquhoun Irvine.

At present the position occupied by substituting groups in sugars is indicated by the use of Greek letters, the carbon atom next to the reducing group being termed the α -atom. Attention is now drawn to the fact that confusion arises when, in addition to the position of the substituents, the stereochemical form (α or β) of the

parent sugar has also to be included in the nomenclature. Several examples were quoted of cases in which, owing to this difficulty, the names at present in use are either misleading or incomplete.

It is now proposed to restrict the use of the expressions α and β , as applied to sugar derivatives, solely to the indication of the configuration of the mutarotatory forms of sugars and of derivatives, such as glucosides, which exist in two stereoisomeric modifications. It is further suggested that the carbon atoms in sugars and their derivatives should be indexed by numbers, the reducing group being termed the No. (1) position in the case of an aldose and No. (2) in the case of a ketose. The numerical system may also be applied to polyhydric alcohols, the numeration in such cases being commenced at the terminal primary alcohol group which normally oxidises to give an aldose. The application of the method is illustrated by reference to synthetical aminoglucosides, aminoglucoses, methylated sugars, and a series of mixed ethers derived from mannitol. Examples of the proposed nomenclature are shown below:



61. "Partly methylated glucoses. Part I. ζ -Monomethyl glucose and γ , ζ trimethyl glucose." By James Colquhoun Irvine and James Patterson Scott.

Glucosediactone, when methylated by the silver oxide reaction, is converted into ζ -monomethyl glucosediactone (b. p. 139—140°/12 mm., $[\alpha]_D - 32.2^\circ$ in alcohol), and, on hydrolysis, ζ -monomethyl glucose is obtained. Both the α - and β -forms of the alkylated sugar were isolated, and the mutarotation of each isomeride determined in various solvents. ζ -Monomethyl α -glucose crystallises in rectangular plates melting at 157—158°, and shows the optical change $[\alpha]_D + 98.6^\circ \rightarrow +68.0^\circ$ in methyl alcohol, whilst ζ -monomethyl β -glucose forms prismatic needles (m. p. 130—132°), which show $[\alpha]_D + 29.6^\circ \rightarrow +68.0^\circ$ in the same solvent. These optical values agree only approximately with those calculated according to Hudson's method (*J. Amer. Chem. Soc.*, 1909, **31**, 66), but, at

the same time, the activity here ascribed to the β -form may not be strictly accurate. Exact agreement with Hudson's figures would demand the alteration of the initial specific rotation of the β -form from $+29.6^\circ$ to $+15.1^\circ$. The sugar gives a *monomethyl methylglucoside*, and is converted into the same monomethyl glucosephenylosazone previously obtained from monomethyl fructose.

The alkylation of glucosemonoacetone yielded $\gamma\delta\epsilon$ -trimethyl glucosemonoacetone as the main product (b. p. $138\text{--}139^\circ/12\text{ mm.}$), from which, on hydrolysis, $\gamma\delta\epsilon$ -trimethyl glucose was isolated as a colourless syrup. Contrary to expectation, the equilibrium mixture of the α - and β -forms of this sugar is lævorotatory ($[\alpha]_D -8.3^\circ$ in water), and so also is the α -isomeride. These optical results are quite abnormal, and are being further investigated.

62. "Partly methylated glucoses. Part II. $\beta\gamma$ -Dimethyl α -glucose and $\beta\gamma$ -dimethyl β glucose." By James Colquhoun Irvine and James Patterson Scott.

The introduction of the benzylidene group into methylglucoside enables three of the hydroxyl groups of the parent sugar to be protected from methylation. The application of the silver oxide reaction to benzylidenemethylglucoside therefore gave $\epsilon\zeta$ -benzylidene- $\beta\gamma$ -dimethyl α -methylglucoside (m. p. $122\text{--}123^\circ$, $[\alpha]_D +97^\circ$ in water). Cautious hydrolysis removed one molecule of benzaldehyde, with the production of $\beta\gamma$ -dimethyl α -methylglucoside (m. p. $80\text{--}82^\circ$, $[\alpha]_D +142.6^\circ$ in acetone), from which, on complete hydrolysis, $\beta\gamma$ -dimethyl glucose was obtained. Both stereoisomeric forms of the sugar were isolated.

$\beta\gamma$ -Dimethyl α -glucose melts at $85\text{--}87^\circ$, and shows downward mutarotation in acetone solution ($[\alpha]_D +81.9^\circ \rightarrow +48.3^\circ$), whilst $\beta\gamma$ -dimethyl β -glucose (m. p. $108\text{--}110^\circ$) exhibits mutarotation in the reverse direction ($[\alpha]_D +5.9^\circ \rightarrow +50.9^\circ$ in acetone). These values are in good agreement with those calculated by Hudson's method. This generalisation seems, however, to be inapplicable to complexes of the type of benzylidenemethylglucoside.

In connexion with the constitution of dimethyl glucose, the influence of configuration in controlling the formation of condensation derivatives of sugars was discussed, and the conclusion was drawn that in benzylidenemethylglucoside the aromatic residue occupies positions (ϵ) and (γ). In the course of the work, a second isomeric form of benzylidene- α -methylglucoside was isolated. The new isomeride, for which the name $d\epsilon\zeta$ -benzylidene- α -methyl- d -glucoside was suggested, melts at $148\text{--}149^\circ$, and shows $[\alpha]_D +98^\circ$ in water.

63. "Perezone."

By Frederic George Percy Remfry.

The hydroxy-quinone perezone (pipitzahoic acid), $C_{15}H_{20}O_3$, is converted by the action of heat into a colourless isomeride melting at $140-141^\circ$ (corr.), and having $[\alpha]_D + 13.1^\circ$, which has been termed *perezol*. This substance is phenolic, and yields a monoacetyl derivative, *acetylperezol*, melting at $114-115^\circ$ (corr.), and having $[\alpha]_D + 6.2^\circ$. The latter is identical with the colourless compound obtained by Anschütz and Leather (*Annalen*, 1887, **237**, 90) by the action of acetic anhydride on perezone.

Perezol and acetylperezol are, further, doubtless identical with the substances prepared by Sanders (P., 1906, **22**, 134), to which, however, different formulæ were assigned.

Perezone yields *alkylquinoles* when treated with magnesium alkyl iodides.

By-products produced in the preparation of hydroxyperezone and perezinone have also been studied.

64. "Polybromides in nitrobenzene solution."

By Alfred Francis Joseph.

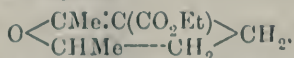
The solubility of potassium bromide in nitrobenzene solutions of bromine has been measured, and from the results the existence of a polybromide, KBr_{2n+1} , may be inferred, for which n is about 1.

The rate of molecular concentration of bromine to molecular solubility of bromide increases from 1.87 to 3.11 as the former increases from 0.075 to 1.5, but it was shown that this does not indicate the presence of polybromides, for which n is greater than 1.

The colorimetric study of the solutions leads to the same conclusion.

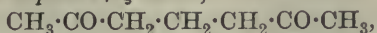
65. "The action of $\alpha\gamma$ -dibromobutane on the sodium derivatives of ethyl acetoacetate and benzoylacetate." By Robert George Fargher and William Henry Perkin, jun.

$\alpha\gamma$ -Dibromobutane reacts readily with the sodium derivative of ethyl acetoacetate with the formation of *ethyl 2:6-dimethyl-2:3-dihydro-1:4-pyran-5-carboxylate*,

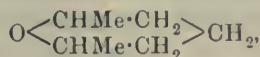


which melts at 35° and distils at $225-226^\circ/750$ mm. The corresponding acid melts at 126° , and is decomposed on distillation into *2:6-dimethyl-2:3-dihydro-1:4-pyran*, a mobile oil distilling at 120° .

When the acid is boiled with water it loses carbon dioxide, and the dihydropyran ring suffers hydrolysis with formation of *heptan- ζ -ol- β -one*, $\text{CH}_3 \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{CH}(\text{OH}) \cdot \text{CH}_3$, a viscid syrup, which distils at $117^\circ/20$ mm., and is converted by oxidation with chromic acid into *heptane- $\beta\zeta$ -dione*,



which melts at about 31° , and distils at $202^\circ/754$ mm. Reduction with sodium amalgam converts *heptan- ζ -ol- β -one* into *heptane- $\beta\zeta$ -diol*, which distils at $140^\circ/50$ mm., and, when heated under the ordinary pressure, is gradually decomposed with the formation of *2:6-dimethyl-2:3:5:6-tetrahydro-1:4-pyran*,

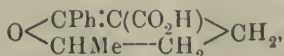


a mobile oil distilling at $118^\circ/756$ mm.

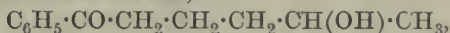
$\beta\zeta$ -Dibromoheptane, $\text{CH}_3 \cdot \text{CHBr} \cdot [\text{CH}_2]_3 \cdot \text{CHBr} \cdot \text{CH}_3$ (b. p. $100^\circ/12$ mm.), is obtained when *heptane- $\beta\zeta$ -diol* is digested with phosphorus tribromide.

ζ -Bromoheptan- β -one, $\text{CH}_3 \cdot \text{CO} \cdot [\text{CH}_2]_3 \cdot \text{CHBr} \cdot \text{CH}_3$, produced by the action of concentrated hydrobromic acid on ethyl dimethyldihydropyrancarboxylate, distils at $130^\circ/50$ mm.

When the sodium derivative of ethyl benzoylacetate is digested with $\alpha\gamma$ -dibromobutane, *ethyl 6-phenyl-2-methyl-2:3-dihydro-1:4-pyran-5-carboxylate* is obtained as a colourless, crystalline mass, melting at 58° . *6-Phenyl-2-methyl-2:3-dihydro-1:4-pyran-5-carboxylic acid*,



melts at 147° , and is decomposed on heating with elimination of carbon dioxide and formation of *6-phenyl-2-methyl-2:3-dihydro-pyran* (b. p. $251^\circ/758$ mm.), and, when boiled with water, the acid yields *α -phenylhexan- ϵ -ol- α -one*,



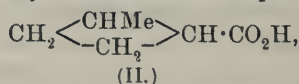
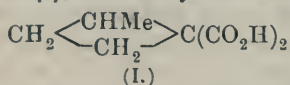
which melts at 34° , and is reduced by sodium amalgam to *phenylhexane- $\alpha\epsilon$ -diol*, which is a syrup. Careful oxidation with chromic acid converts phenylhexanol into *α -phenylhexane- $\alpha\epsilon$ -dione*,



a crystalline substance, which melts at 65° . *Phenyl ϵ -bromo- α -phenylhexan- α -one*, $\text{C}_6\text{H}_5 \cdot \text{CO} \cdot [\text{CH}_2]_3 \cdot \text{CHBr} \cdot \text{CH}_3$, is obtained, when ethyl phenylmethyldihydropyrancarboxylate is left in contact with concentrated hydrobromic acid, as a syrup which distils with much decomposition at about $188^\circ/21$ mm.

66. "The action of α -dibromobutane on the sodium derivative of ethyl malonate." By Gibbs Blackstock and William Henry Perkin, jun.

This interaction leads to the formation of a number of substances, one of which is *ethyl 1-methylcyclobutane-2:2-dicarboxylate*. This ester, on hydrolysis, yields *1-methylcyclobutane-2:2-dicarboxylic acid* (I), which crystallises from dilute hydrochloric acid in prisms,

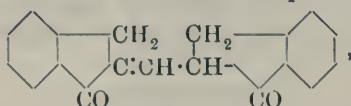


and melts at 160—162°. This dibasic acid is decomposed on distillation, with elimination of carbon dioxide and formation of *1-methylcyclobutane-2-carboxylic acid* (II), which is an unpleasant smelling oil distilling at 198°/755 mm. The authors are engaged on the resolution of this acid into its active constituents, and also on the examination of the other substances produced in the above interaction.

67. "Studies on cyclic ketones. Part III."

By Siegfried Ruhemann and Stanley Isaac Levy.

The constitution of the red condensation product,

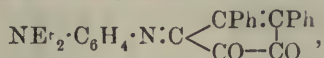


previously obtained by the action of heat on 2-hydroxymethylene-1-hydrindone (T., 1912, 101, 2549) has been verified by the study of its behaviour towards bromine. Experiments have now been made with the object of preparing similar substances from diphenylcyclopentenone and from β -hydrindone, but these attempts were unsuccessful, as no hydroxymethylene derivatives of these ketones could be obtained.

These experiments, in turn, led to the investigation of the action of aromatic aldehydes on the two ketones. It was found that, under the influence of hydrogen chloride, condensation readily occurs with two molecules of the aldehyde. With *o*-hydroxyaldehydes the reaction proceeds one stage further, polycyclic *spiropyran* compounds being formed. Substances of this nature have been obtained from both ketones by the action of salicylaldehyde and of 1-aldehydo-2-naphthol; they are characterised by the deep colour and strong fluorescence of their solutions in concentrated sulphuric acid.

The action of *p*-nitrosodiethylaniline on diphenylcyclopentenone is found to be exactly parallel to the reaction with nitrosodimethyl-

aniline already investigated (T., 1912, 101, 42), with the remarkable difference that the compound



which is formed from the product by the action of hydrochloric acid, does not possess the property of forming colloidal solutions, which characterises the analogous derivative obtained from *p*-nitrosodimethylaniline.

68. "The interaction of chlorine and hydrogen. The influence of mass." By David Leonard Chapman and Leo Kingsley Underhill.

The authors have determined the sensitiveness to light of mixtures containing chlorine, oxygen, and hydrogen, the object having been to find the variation in the rate of formation of hydrogen chloride when the concentration of the chlorine and oxygen were kept constant and that of the hydrogen varied. The concentration of the oxygen was small in comparison with that of the chlorine. It was found that as the concentration of the hydrogen was increased from zero, the sensitiveness increased at first very rapidly, attained a maximum value, and then gradually fell. Thus, a mixture which contained 50 per cent. of hydrogen was only twice as sensitive as one which contained only 3 per cent., whilst the sensitiveness of a mixture containing 100 per cent. of hydrogen was less than that of a mixture containing 50 per cent., in the ratio of 7 to 10.

The above results demonstrate conclusively that the rate of formation of hydrogen chloride is not under ordinary conditions proportional to the number of impacts per second between pairs of molecules of hydrogen and chlorine. Accordingly the conclusion of Wilderman (*Phil. Trans.*, 1902, 199, 337), that the rate of interaction of chlorine and carbon monoxide is proportional to the concentration of the colourless constituent is not true for the closely analogous chemical action between chlorine and hydrogen. Even if true therefore for the special case investigated by Wilderman, his conclusion cannot be regarded as generally applicable to photochemical changes.

The results of the authors are in agreement with the view that by the action of light a comparatively unstable form of chlorine is produced, and that this, in the presence of a sufficient quantity of hydrogen, is almost entirely converted into hydrogen chloride, whereas in the presence of a deficiency of hydrogen it reverts largely to ordinary chlorine.

69. "The behaviour of calcium and magnesium salts with soap solutions, and the determination of hardness of water." By Helen Masters and Henry Llewellyn Smith.

It is well known that in the titration of hard waters with soap solution equivalent amounts of calcium and magnesium salts use up different quantities of soap, magnesium salts using up more than calcium salts.

It is the unsaturated acids that cause this difference, saturated fatty acids giving soap solutions, which give accurate results with calcium salts and magnesium salts or with mixture of the two.

Potassium myristate makes a convenient stable solution for this purpose.

The solubility of calcium oleate decreases, whilst the solubility of magnesium oleate increases with rise of temperature.

With magnesium salts and sodium oleate a precipitate soon forms after titration at 15°, and this carries down or adsorbs some sodium oleate, and so more soap is required. With calcium salts and sodium oleate at 15° no precipitate forms under the usual conditions, the liquid remaining translucent.

With soaps made from the saturated fatty acids precipitates form with both calcium and magnesium salts.

70. "Organic derivatives of bismuth." (Preliminary note.)
By Frederick Challenger.

With the object of preparing organic compounds of bismuth possessing an asymmetric structure, and the resolution of which into optically active components might, under suitable conditions, conceivably be accomplished, the preparation and properties of certain organic derivatives of bismuth are being studied.

Pfeiffer and Pietsch (*Ber.*, 1904, **37**, 4620) showed that bismuth chloride reacts with an ethereal solution of magnesium phenyl bromide with the formation of triphenylbismuthine in a 25 per cent. yield. This compound was first prepared by Michaelis and Polis (*Ber.*, 1887, **20**, 54).

During the course of the present research triphenylbismuthine has been prepared in an analogous manner from bismuth bromide in a yield of about 50 per cent. Diphenylbromobismuthine, Ph_2BiBr (m. p. 158°), was simultaneously produced. Michaelis and Marquard (*Annalen*, 1889, **251**, 327) first prepared this substance by the interaction of bismuth bromine and triphenylbismuthine in ethereal solution, and gave the melting point as 157—158°.

Pfeiffer and Pietsch do not mention the formation of diphenylchlorobismuthine in their experiments.

When treated with magnesium α -naphthyl bromide in ethereal solution, diphenylbromobismuthine dissolves and a solid is precipitated. Diphenyl- α -naphthylbismuthine has, however, not yet been isolated from the reaction mixture.

Tri- α -naphthylbismuthine, which does not seem to have been previously described, has been prepared from bismuth bromide and magnesium α -naphthyl bromide. It crystallises in almost colourless, glistening needles, melting at 235° (uncorr.).

When tri- α -naphthylbismuthine (2 mols.) is treated with bismuth bromide (1 mol.) in ether-chloroform solution a golden-yellow, crystalline substance separates. This crystallises well from benzene (m. p. 211° uncorr.), and has not yet been analysed, but from its properties and method of formation it would appear to be di- α -naphthylbromobismuthine.

The interaction of bismuth bromide and magnesium benzyl chloride under conditions in which a good yield of triphenylbismuthine is obtained, does not seem to lead to the formation of tribenzylbismuthine, $\text{Bi}(\text{CH}_2\text{Ph})_3$. A yellow substance containing bismuth, bromine, and organic matter, which decomposes without melting and is insoluble in most solvents except glacial acetic acid, is the principal product.

The action of the Grignard reagent on derivatives of quinquivalent bismuth, such as triphenylbismuthine dibromide, Ph_3BiBr_2 , is being investigated.

71. "The estimation of mercury as metal by the dry method."

By Alexander Charles Cumming and John Macleod.

The estimation of mercury as metal by the dry method as ordinarily applied is very troublesome, although it gives accurate results. It is found that the process is simplified, and that equally good results are obtained if the mercury compound is heated in a small Penfield tube with a mixture of lime, iron filings, and lead chromate.

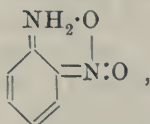
The modified method was applied to the determination of mercury in mercuric chloride, mercuric sulphide, cinnabar, and mercuric iodide; the results were in all cases satisfactory.

72. "Studies in the diphenyl series. Part IV. The absorption spectra of the two isomeric *o*-dinitrobenzidines." By John Cannell Cain, Alexander Killen Macbeth, and Alfred Walter Stewart.

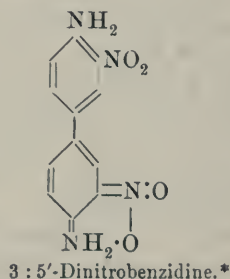
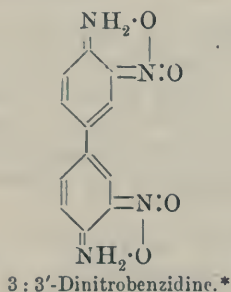
A comparison between the absorption spectra of the two isomeric *o*-dinitrobenzidines (Cain, Coulthard, and Micklethwait, T., 1912,

101, 2298) and that of *o*-nitroaniline shows that there is a general resemblance between the spectrum of the latter and that of 3:3'-dinitrobenzidine, whilst the spectrum of 3:5'-dinitrobenzidine differs distinctly from them.

The authors regard *o*-nitroaniline as having the quinonoid constitution:



and, applying this conception to the case of the *o*-dinitrobenzidines, it was shown that their constitutions are satisfactorily explained by the formulæ:



The constitutions of the isomeric *o*-dinitrodiphenyls and the acetyl derivatives of the isomeric *o*-dinitrobenzidines may be explained in an analogous manner.

73. "A novel method for resolving externally compensated amines: derivatives of *d*- and *l*-oxymethylenecamphor." By William Jackson Pope and John Read.

The condensation products which *d*- and *l*-oxymethylenecamphor form with externally compensated hydroxyhydrindamine and α -phenylethylamine can be conveniently employed in the resolution of these bases into their optically active components. It was also shown that α -camphylamine is a pure optically active base with the aid of the same oxymethylene derivatives. *d*-Oxymethylenecamphor can be used to effect a ready separation of *d*-bornylamine from the *d*-neobornylamine which accompanies it.

* These names are retained for convenience of reference.

74. "A new iron bacterium." By Ernest Moore Mumford.

A new bacillus has been isolated from the Bridgewater Canal tunnels at Worsley, Lancashire.

The bacillus designated by the laboratory number, M7, exerts a specific action on solutions containing iron. The organism is a facultative ærobe, and the action on iron solutions varies as the conditions are ærobie or anærobie.

Under ærobie conditions the iron in solution, whether ferrous or ferric, is precipitated as ferric hydroxide. Under anærobie conditions neither ferrous nor ferric solutions are precipitated, but ferric hydroxide already precipitated biologically or chemically is dehydrated and reduced to bog-ore.

In Nature these two actions are symbiotic, and are probably the cause of the deposits of bog-ore hitherto attributed to higher bacteria alone.

An enzyme has been separated from the organism by the usual methods, and all the chemical reactions of the living organism have been reproduced by the enzyme. The optimum of the enzyme is 70°.

Neither the specific action of the organism on iron solutions nor the enzyme are produced in the absence of nitrogen in the medium.

The enzyme is a complex substance containing amino-groups, but the basicity of the enzyme to acids bears no relation to the precipitating power.

The organism is a short, round-ended bacillus, 2 microns by 0.4 micron in size. It exhibits a varying motility, and forms endospores and involution forms.

It grows well on ordinary media, the growth on potato of greenish-brown nodules being characteristic.

75. "The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures." By John Norman Collie and Hubert Sutton Patterson.

A detailed account of an investigation of which a preliminary note has already appeared (this vol., p. 22).

76. "The double platinic and cupric iodides of substituted ammonium bases." By Rasik Lal Datta.

The author has prepared the *platini-iodides* of rubidium, cæsium, methyl-, ethyl-, allyl-, dimethyl-, diethyl-, trimethyl-, triethyl-, tetramethyl-, and tetraethyl-ammonium, anilinium, and pyridinium.

The *cupri-iodides* of tetraethyl- and tetraphenyl-ammonium, pyridinium, and quinolinium were also described.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Berry, Arthur John. The atmosphere. Cambridge 1913. pp. x + 146. ill. 1s. 0d. net. (*Recd.* 18/2/12.) From the Author.

Canada, Department of Mines. Report on the utilization of peat fuel for the production of power. By *B. F. Haanel*. Ottawa 1912. pp. xii + 145. ill. (*Recd.* 6/2/13.)

— **Mica: its occurrence, exploitation, and uses.** By *Hugh S. de Schmid*. Ottawa 1912. pp. xiv + 411. ill. (*Recd.* 6/2/13.)

From the Department.

Plimmer, Robert Henry Aders. The chemical constitution of the proteins. 2nd edition. Part II. London 1913. pp. xii + 107. 3s. 6d. net. (*Recd.* 11/2/13.)

From the Publishers: Messrs. Longmans, Green & Co.

At the next Ordinary Scientific Meeting on **Thursday, April 3rd, 1913, at 8.30 p.m.**, the following papers will be communicated:

"Studies in the camphane series. Part XXXIV. Configuration of the eight oximino-derivatives of camphorquinone." By *M. O. Forster*.

"Synthesis of a methyl tetrose." (Preliminary note.) By *R. Gilmour*.

"Experiments on the Walden Inversion. Part IX. The inter-conversion of the optically active phenylmethylecarbinols." By *A. McKenzie* and *G. W. Clough*.

"The vapour density of ammonium nitrate." By *P. C. Rây* and *S. C. Jana*.

"Externally compensated hydroxyhydrindenehydrazine, its derivatives, and resolution into optically active components." By *D. H. Peacock*.

"Studies in substituted quaternary azonium compounds containing an asymmetric nitrogen atom. Part I. Resolution of phenylethylmethylazonium iodide into optically active components." By *B. K. Singh*.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 29

No. 413.

Friday, March 14th, 1913, Annual General Meeting. Professor PERCY F. FRANKLAND, LL.D., F.R.S., President, in the Chair.

Mr. C. H. HAMPSHIRE and Mr. T. R. MERTON were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The PRESIDENT presented the Report of the Council on the progress of the Society from January, 1912, to date, and a statement was made by the TREASURER as to the Income and Expenditure for 1912. The adoption of the Report of the Council, together with the Balance Sheet and Statement of Accounts for the year ended December 31st, 1912, was proposed by Mr. T. FAIRLEY, seconded by Professor A. G. GREEN, and carried unanimously.

A Vote of Thanks to the Auditors was proposed by the TREASURER, seconded by Dr. S. B. SCHRYVER, and acknowledged by Professor J. M. THOMSON.

REPORT OF COUNCIL, 1912—1913.

THE Annual Reports of the Council have, in the past, dealt with the work of the Society during the previous calendar year, but

the general portion of the present Report refers to the period from the commencement of 1912 to March, 1913, and this portion of future Reports will concern the period from one Annual General Meeting to the next Annual General Meeting.

On the 31st December, 1911, the number of Fellows was 3,104. During 1912, 184 Fellows were elected, and 7 have been reinstated, the gross total being 3,295. The Society has lost 33 Fellows by death, 52 have resigned, 1 has been elected an Honorary and Foreign Member, the elections of 4 Fellows have become void, and 47 Fellows have been removed for non-payment of Annual subscriptions.

The total number of Fellows, therefore, on the 31st December, 1912, was 3,158, showing a net increase of 54 over the preceding year. The number of Fellows elected during 1912 exceeds the average for the past six years by 21 Fellows, and the small net increase in the number of Fellows is accounted for by the large number of resignations and of Fellows removed for non-payment of Annual Subscriptions.

The names of the deceased Fellows, with the dates of their election, are:

George Attwood (1872).
 Alfred Edward Beanes (1902).
 Andrew Heggie Black (1879).
 Robert Holford Macdowall Bosanquet (1865).
 John Macdonald Cameron (1875).
 Miles Coupe (1905).
 Edward Divers (1860).
 Arthur Edward Ekins (1883).
 Algernon John Elkington (1911).
 John Oliver Ferrier (1902).
 Angus Fraser (1867).
 Thomas Griffiths (1879).
 Alexander Hill (1882).
 Reginald Howell (1880).
 Otis Coe Johnson (1897).
 Humphrey Owen Jones (1900).
 David Skinner Kemp (1867).

William Frederick Laycock (1890).
 Theodore David Lichtenstein (1878).
 Charles William Low (1884).
 John McArthur (1887).
 William Masters (1873).
 Henry de Mosenthal (1890).
 Benjamin Edward Reina Newlands (1864).
 John Pattinson (1863).
 B. Venkata Rao (1911).
 Arthur Richardson (1883).
 Henry Salt (1863).
 Henry Seward (1870).
 William Robert Rigg Starling (1906).
 James Pim Strangman (1887).
 John Wade (1890).
 William Ord Wootton (1908).

The following Fellows have resigned :

James Henry Allan.	Antholl Francis McEwen.
Allan Baguley.	Alwyne Harcourt Meade.
John Augustus Hermann	Frederick Norton Kay Menzies
Brincker.	Christian Müller.
Arthur Brooke.	Herbert Simpson Newbould.
John Coggin Brown.	Frederick Norrington.
John Arthur Carpenter.	Robert Cecil Owen.
William Clacher.	Herbert Spindler Pullar.
George Bertram Cockburn.	William Ralston.
William Cormack.	John Armstedt Ray.
Samuel Herbert Cox.	David Gibson Riddick.
William Salvador Curphey.	James Beglar Robinson.
Frederick Davis.	John Robinson.
Henry Wilson Davis.	Francis Murray Rogers.
Arthur William Eastwood.	William Saunders.
Vincent Edwards.	Alfred Henry Scholefield.
Nevil Norton Evans.	Frederick William Skirrow.
John Edwin Farmer.	Henry George Stacey.
Reginald Williams Ferguson.	Samuel Stansfield.
John Thomas Fox.	William Scott Tebb.
Gilbert Gunn.	John Traquair.
Thomas Hartley.	Stephen Herbert Trimen.
William Pellew Harvey.	Herbert Wood Watson.
Alfred Kirby Huntington.	Thorp Whitaker.
George Washington Kilner.	*Frederick Louis Wilder.
Stephen Joshua Lett.	William Arthur Reginald Wilks.
Arthur Thomas McDougall.	

* Since reinstated

At the end of 1911 the number of Honorary and Foreign Members was 31. Since that date the Society has mourned the loss of Lecoq de Boisbaudran and J. W. Mallet, whilst on March 7th, 1912, P. A. Guye, T. B. Osborne, P. Walden, and R. Willstätter were elected. The total number of Honorary and Foreign Members, therefore, at the present time is 33.

The Council has great pleasure in offering hearty congratulations to the following, who, in 1912, attained their Jubilee as Fellows :

William Esson, elected May 1st, 1862.

William Adam Dixon, elected Dec. 18th, 1862.

Edmund James Mills, elected Dec. 18th, 1862.

The Council desires to record its high appreciation of the

services rendered to the Society over a period of eight years by the retiring Senior Secretary, Professor Crossley. Professor Crossley's tenure of this arduous office has been distinguished by great administrative skill, by sound judgment, and by unfailing tact. The Society is deeply indebted to him for the generous manner in which he has placed his time and energies at its disposal.

During the year, 336 scientific communications were made to the Society, 256 of which have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1912 contains 2,568 pages, of which 2,431 are occupied by 266 memoirs, the remaining 137 pages being devoted to the Obituary Notices, the Becquerel, Cannizzaro, and Moissan Memorial Lectures, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contains 259 memoirs which occupy 2,270 pages.

The Journal for 1912 contains 5,497 abstracts, which extend to 2,264 pages, whilst the abstracts for 1911 numbered 5,236, and occupied 2,200 pages. The abstracts may be classified as follows:

PART I.

	Pages.	No. of Abstracts.
Organic Chemistry	1,044	1,796

PART II.

General and Physical Chemistry		1,238
Inorganic Chemistry		493
Mineralogical Chemistry		120
Physiological Chemistry		737
Chemistry of Vegetable Physiology and Agriculture		385
Analytical Chemistry		728
	1,220	3,701
Total in Parts I. and II	2,264	5,497

The possibility of Fellows resident abroad procuring through the Society fuller abstracts of papers than appear in the Journal has been under consideration, and the Council has decided:

"That persons requiring expanded Abstracts or translations of papers published in other Journals should apply to the Editor. Ten shillings per printed page (about 500 words) will be charged, and

payment should be made to the Editor at the time the request for a translation or fuller abstract is forwarded to him."

The Council has also resolved :

"That in order to obtain a more equal division of abstracts, those of Physiological Chemistry and the Chemistry of Vegetable Physiology and Agriculture shall, in future, be included in Part I. of the Abstracts, instead of in Part II."

Volume V. of the Collective Index of the Journal and Proceedings of the Chemical Society (1903--1912) will be issued in two parts: Part I (Author Index) in 1913, and Part 2 (Subject Index) in 1914. Such prompt publication of the Collective Index is rendered possible by the system employed for the preparation of the Annual Indexes, as the work done in connection with the latter can be largely utilised for the Collective Index.

The Transactions for 1912 contain Obituary Notices of Walthère Spring and Louis Joseph Troost, Honorary and Foreign Members. Obituary Notices also appear of John Attfield, John Muter, and Nevil Story-Maskelyne, and the Council expresses its thanks to those gentlemen who have kindly prepared these notices.

The Society was represented at the funeral of the late Lord Lister by the President.

Since the last Report was published, the Society has had the privilege of listening to an account of the life and work of :

- (a) S. Cannizzaro, from Sir William Tilden.
- (b) H. Moissan, from Sir William Ramsay.
- (c) H. Becquerel, from Sir Oliver Lodge.

The Council has considered the desirability of issuing a second volume of Memorial Lectures, and has decided to postpone the publication until after the delivery of the Ladenburg Lecture by Prof. Kipping and the Van't Hoff Lecture by Prof. James Walker, both of which lectures, it is hoped, will be delivered before the close of the present Session.

The President, Professor P. F. Frankland, was the official representative of the Society at the celebration, in July, 1912, of the 250th Anniversary of the Foundation of the Royal Society, when an address of congratulation was presented on behalf of the Chemical Society. The text of the address appeared in the Proceedings, Vol. 28, p. 248.

The Eighth International Congress of Applied Chemistry held in Washington and New York in September, 1912, was attended by Dr. M. O. Forster, Sir William Ramsay, and Sir Boverton Redwood as delegates of the Chemical Society.

The Society was represented at the Centenary Anniversary of the Academy of Natural Sciences of Philadelphia in March, 1912, by the late Professor J. W. Mallet and by Professor Alexander Smith; at the Bicentenary Festival of the Medical School, Trinity College, Dublin, in July, 1912, by Professor G. T. Morgan; and at the 25th Anniversary Celebration of the Verein Deutscher Chemiker by Dr. R. Messel.

During the Summer Vacation of 1912 the Society's Rooms were redecorated throughout. After consultation with the architect originally responsible for the scheme of ventilation in the Meeting Room, the Council also decided to place a large suction-fan in the roof over the Library, directly connected with the ventilating flues of the Meeting Room. This has had the result of materially improving the atmosphere of the room.

A conference of representatives of those Chemical Societies in Great Britain publishing abstracts of papers appearing in other Journals is taking place, at the suggestion of the Council, to consider the possibility of decreasing the cost of production of such abstracts. Delegates have been appointed by the various Societies as follows:

Society of Chemical Industry.—R. Messel, J. Lewkowitsch.

Society of Public Analysts.—L. Archbutt, H. D. Richmond, O. Hehner.

Institute of Brewing.—J. L. Baker, A. R. Ling.

Institute of Metals.—W. Rosenhain, G. S. Scott.

Society of Dyers and Colourists.—E. Knecht, W. M. Gardner.

Iron and Steel Institute.—J. E. Stead, G. C. Lloyd.

The Council Meetings of the International Association of Chemical Societies held in Berlin in April, 1912, were attended by the three representatives of the Society, Professor A. W. Crossley, Professor P. F. Frankland, and Sir William Ramsay, and an account of the work of the Council appeared in the Proceedings for 1912 (p. 201). The General Expenses of the Association for the previous year amounted to £60, of which sum the share of the Chemical Society was £10 6s. 7d.

The next meetings of the Council will be held in London during September, 1913, and the Officers of the Association are:

Sir William Ramsay, *President*.

Prof. Percy F. Frankland, *Vice-President*.

Prof. Arthur W. Crossley, *General Secretary*.

who remain in office until the end of the meeting.

The Society has received through Sir Edward Thorpe the Annual Report of the International Committee on Atomic Weights, 1913,

together with a Table of Atomic Weights. The Report appears in the Proceedings, p. 213, and in the Transactions, p. 1829.

The Council has made a further donation of £10 to the International Commission of Publication of Annual Tables of Constants and Numerical Data, Chemical, Physical, and Technological.

In the last report it was mentioned that it was proposed to raise a Memorial to the late Prof. J. H. van't Hoff, and that subscriptions would be received by the Treasurer. The sum of £65 4s. was subscribed by Fellows and forwarded to the Memorial Committee.

The Council has considered a request from the Director of the Municipal Laboratory of Paris for permission to arrange for the preparation of a French translation of the Annual Reports, and has agreed to the proposition. The publication of the work will be carried out by Messrs. Hermann et Fils, of Paris.

At the request of the Rev. W. G. Searle, Keeper of Coins at the Fitzwilliam Museum, Cambridge, the Council has presented to the Museum copies of the Longstaff Medal and Faraday Medal.

The number of books borrowed from the Library during the year was 1,825, as against 1,808 during the previous year; of these 491 were issued by post, as against 419 in the preceding year.

The additions to the Library comprise: 135 books, of which 70 were presented; 482 volumes of periodicals (representing 237 journals), and 76 pamphlets; as against 171 books, 438 volumes of periodicals (representing 237 journals), and 87 pamphlets last year.

The Library is indebted to Mr. J. A. Audley for a welcome gift of early journals.

The yearly increasing size of the Library will necessitate the consideration in the immediate future of the provision of adequate accommodation for its growth. In a statement of the Librarian appended to the President's Address in 1890, it was recorded that the Library then contained 9,884 volumes, made up of 3,082 volumes of systematic works, and 6,802 periodicals, with the addition of 1,450 pamphlets. At the present time it is estimated that the Library contains 21,256 volumes, of which 5,983 are systematic works, 15,273 volumes of periodicals, together with 3,500 pamphlets. It is thus seen that in twenty-two years the periodicals in the Library have increased in number of volumes by 124·5 per cent., the systematic works by 94 per cent., and the general total by 115 per cent.

It is estimated that shelf-room for 7,000 volumes will be required to accommodate the increase of volumes for the next ten years. At the close of 1913 there will at least be an additional 650 volumes to accommodate, whilst the empty shelving now at liberty will only contain some 250 volumes. Therefore, not only for the future, but

also for the immediate present, additional Library accommodation is essential, and the Council has referred this question to the House and Library Committees.

Taking into account the occurrence of some items of exceptional expenditure, such as the decoration of the whole building and the ventilation of some of our rooms, it is satisfactory to find that, after meeting these expenses out of the income for the year, there is still an excess of income over expenditure of £176 1s. 7d. In 1913 the needs of the Library in the direction of providing accommodation for its continuous growth will necessarily entail considerable outlay, as pointed out above. For 1912 the income from all sources amounted to £8120 12s. 3d., and the expenditure to £7944 10s. 8d.; for 1911 the corresponding amounts were £7735 11s. 6d. and £7499 3s. 10d. respectively. In other words, our income has increased by £385 0s. 9d., and our expenditure by £444 16s. 10d. The redecoration, improvements in ventilation, etc., alone account for £265 of this, and the increase in cost of the *Journal* for £124 2s. 8d.

As it was found impossible without either realising some of our investments or raising the annual subscription to give to Fellows without charge Vol. V. of the Collective Index, the price charged for it (thirty shillings) was fixed so as to cover as nearly as possible the cost of printing and distribution. The cost of preparing the index for the press is included in the editor's salary, and under the new arrangements its publication has been arranged for with an expedition hitherto impossible. From the number of Fellows who have applied and the number of copies which we may reasonably hope to sell to the public through our publishers, it seems probable that this volume of the Collective Index will not entail any serious outlay on the part of the Society.

The net income of the Research Fund for the year amounted to £367 6s. 5d., and by drawing on the balance in hand to the extent of £15 3s. 7d., grants were made amounting in all to £361, whilst the Longstaff Medal and Honorarium accounted for the remaining £21 10s.

Liabilities.

	£	s.	d.	£	s.	d.
To Subscriptions received in advance .. .. .	...	...	...	301	10	0
„ Sundry Creditors .. .. .	...	...	...	1185	5	7
„ Research Fund :—						
As per last Balance Sheet	10486	9	1			
Less Excess of Expenditure over Income for the year	15	3	7	10481	5	6
Chemical Society : Excess of Assets over Liabilities :—						
As per last Balance Sheet	20303	7	9			
Add Excess of Income over Expenditure for the year	176	1	7	20569	9	4

Assets.

	£	s.	d.	£	s.	d.
By Investments (value when acquired) :—						
£6730 Metropolitan Consolidated 3½ per cent. Stock	7212	8	6			
£1050 London and North Western Railway 3 per cent. Debenture Stock	839	12	0			
£1520 14s. 3d. Cardiff Corporation 3 per cent. Stock	1650	0	0			
£1400 India 2½ per cent. Stock	1316	1	0			
£2400 Bristol Corporation 2½ per cent. Debenture Stock	2070	2	0			
£4841 Midland Railway 2½ per cent. Preference Stock	3572	2	5			
£1200 Leeds Corporation 3 per cent. Stock	1143	1	0			
£1500 Transvaal 3 per cent. Guaranteed Stock, 1929/53	1460	13	6			
£1200 North British Railway 3 per cent. Debenture-Stock	1033	11	0			
£700 Canada 2½ per cent. Stock, 1950/50	704	8	6			
(Estimated present value of Investments, £17997 8s. 5d.)				21001	19	11
„ Sundry Debtors :—						
Advertising Account	75	7	0			
Less Commission accrued	5	8	5			
Messrs. Gurney & Jackson	69	18	7			
Telephone Deposit	460	7	1			
„ Subscriptions in Arrear, £493. Estimated to realise	1	0	0			
„ Amount paid on account of International Association of Chemical Societies						
„ Insurance paid in advance						
„ Cash at Bank, Current Account	106	8	10			
„ Cash in hand	10	4	11			
„ Research Fund :—						
Investments (value when acquired) :						
£1000 North British Railway 4 per cent. No. 1 Preference Stock	1010	0	0			
£4400 Metropolitan Consolidated 3½ per cent. Stock	4587	18	0			
£1034 Great Western Railway 2½ per cent. Debenture Stock	1049	15	11			
£1142 10s. New South Wales 3 per cent. Stock	1000	0	0			
£1122 Metropolitan Water Board 3 per cent. „ B „ Stock	1002	16	9			
£1365 Midland Railway 2½ per cent. Debenture Stock	1010	0	0			
£806 Victoria 3 per cent. Stock	706	6	2			
(Estimated present value of Research Fund Investments, £9481 17s. 10d.)				10366	17	7
„ Cash at Bank	114	7	11			
				10481	5	6

INCOME AND EXPENDITURE ACCOUNT

<i>Income.</i>		£	s.	d.	£	s.	d.
To Life Compositions					386	0	0
„ Admision Fees					692	0	0
„ Annual Subscriptions—							
Received in advance, on account of 1912		232	0	0			
„ during 1912		4471	0	0			
„ „ „ 1911		354	0	0			
„ „ „ 1905-10		18	0	0			
		5075	0	0			
Less amount included in last year's Income, being valuation of Arrears as per last Balance Sheet		360	0	0			
		4715	0	0			
Add Arrears at date: 1912 £448; 1911 £30; 1910 £15, estimated to realise as per Balance Sheet		350	0	0			
					5065	0	0
„ Lady Subscribers					6	0	0
„ Investments:—							
Dividends on £6730 Metropolitan Consolidated 3½ per cent. Stock ...		221	16	4			
„ £1050 London and North Western Railway 3 per cent.							
Debenture Stock		29	13	2			
„ £1520 14s. 3d. Cardiff Corporation 3 per cent. Stock ...		42	19	4			
„ £1400 India 2½ per cent. Stock		32	19	4			
„ £2400 Bristol Corporation 2½ per cent. Debenture Stock ...		56	10	0			
„ £4341 Midland Railway 2½ per cent. Preference Stock ...		102	3	10			
„ £1200 Leeds Corporation 3 per cent. Stock		33	18	0			
„ £1500 Transvaal 3 per cent Guaranteed Stock, 1923/53		42	7	6			
„ £1200 North British Railway 3 per cent. Debenture							
Stock		33	18	0			
„ £700 Canada 3½ per cent. Stock 1930/50		23	1	6			
„ Income Tax Recovered		36	13	10			
„ Interest on Deposit Account		16	16	8			
					672	17	6
„ Publications:—							
Sales:							
Journals		916	17	6			
Proceedings		47	14	9			
General Index		20	6	0			
Library Catalogue		1	7	0			
List of Fellows		4	0	0			
Atomic Weight Tables		0	9	2			
Jubilee Volume		0	5	6			
Annual Reports on Progress of Chemistry		185	8	11			
		1176	8	10			
Less Publishers' Commission		108	17	9			
		1067	11	1			
„ Proceeds of Advertisements in Journal... .. £20 16 10							
Less Commission 13 10 10							
		102	6	0			
					1259	17	1
„ Sale of Waste-paper, etc.					2	13	2
„ Subscriptions from other Societies:—							
Society of Chemical Industry		9	9	0			
Society of Public Analysts		11	0	6			
Optical Society		10	10	0			
British Science Guild		4	4	0			
Institute of Chemistry		1	1	0			
					86	4	6
					£8120	12	3

I have examined the above Accounts with the Books and Vouchers of the Society, and the Investments.

23, QUEEN VICTORIA STREET, E.C.
3rd March, 1913.

W. B. KEEN,
Chartered Accountant.

FOR THE YEAR ENDED 31ST DECEMBER, 1912.

Expenditure.

	£	s.	d.	£	s.	d.
By Expenses on account of Journal and Proceedings:—						
Salary of Editor, including Indexing	570	0	0			
Salary of Sub-Editor	200	0	0			
Editorial Postages	31	1	4			
Abstractors' Fees	546	10	3			
Printing of Journal	2953	10	1			
Banding	60	15	8			
Printing of Advertisements	52	2	6			
Wrappers and Addressing	119	19	5			
Distribution of Journal	623	13	4			
Authors' Copies	192	19	5			
Insurance of Stock at Clay's	6	4	3			
Printing of Proceedings	218	12	5			
Banding	8	14	8			
Distribution	44	9	8			
				5633	12	7
„ Annual Reports on the Progress of Chemistry				415	6	0
„ Purchase of back numbers of Journal				7	12	1
„ List of Fellows				72	7	9
„ Library Expenses:—						
Salary of Librarian and Assistant... ..	100	12	0			
Books and Periodicals	246	12	3			
Binding	25	4	7			
Bookcases	14	19	4			
				477	8	2
„ Indexing for International Catalogue				30	0	0
„ Donation to International Commission of Publication of Annual Tables of Constants and Numerical Data, Chemical, Physical and Technological				10	0	0
„ International Association of Chemical Societies				10	6	7
„ Administrative Expenses:—						
Salary of Assistant Secretary	290	0	0			
Salary of Office Assistant... ..	31	3	6			
Wages (Commissionaire, Housekeeper, and Charwoman)	156	15	6			
Coal and Lighting	41	13	2			
House Expenses and Repairs	369	9	6			
Tea Expenses	29	14	0			
Insurances	11	0	3			
Accountants' Charges	21	0	0			
Commission on Recovery of Income Tax	1	16	8			
Printing	127	1	6			
Stationery	76	1	5			
Postages	103	2	11			
Illuminated Address	3	3	0			
Miscellaneous Expenses	25	7	1			
				1287	17	6
„ Balance, being excess of Income over Expenditure, carried to Balance Sheet				176	1	7

£8120 12 3

certify them to be in accordance therewith. I have also verified the Balance at the Bankers

Approved—

JOHN M. THOMSON,
SAMUEL RIDEAL,
JAMES J. DOBBIE.

A Vote of Thanks to the Treasurer, Secretaries, Foreign Secretary, and Council for their services during the past year, proposed by Mr. W. F. REID, seconded by Mr. A. CHASTON CHAPMAN, was acknowledged by Professor ARTHUR W. CROSSLEY.

The PRESIDENT then delivered his address entitled "The Walden Inversion." Sir WILLIAM TILDEN proposed a Vote of Thanks to the PRESIDENT, coupled with the request that he would allow his address to be printed in the Transactions. The motion was seconded by Professor HAROLD B. DIXON, and acknowledged by the PRESIDENT.

The Report of the Scrutators was presented, and the President declared that the following had been elected as Officers and Council for the ensuing year :

President: William Henry Perkin, Sc.D., LL.D., F.R.S.

Vice-Presidents who have filled the Office of President: Henry Edward Armstrong, Ph.D., LL.D., F.R.S.; Alexander Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, O.M., D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; Harold Baily Dixon, M.A., Ph.D., F.R.S.; Percy Faraday Frankland, Ph.D., LL.D., F.R.S.; Augustus George Vernon Harcourt, M.A., D.C.L., F.R.S.; Raphael Meldola, D.Sc., LL.D., F.R.S.; Hugo Müller, Ph.D., LL.D., F.R.S.; William Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; James Emerson Reynolds, Sc.D., M.D., F.R.S.; the Rt. Hon. Sir Henry Enfield Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William Augustus Tilden, D.Sc., F.R.S.

Vice-Presidents: Herbert Brereton Baker, M.A., D.Sc., F.R.S.; George Thomas Beilby, LL.D., F.R.S.; Horace Tabberer Brown, LL.D., F.R.S.; Edmund James Mills, D.Sc., LL.D., F.R.S.; Gilbert Thomas Morgan, D.Sc.; William Jackson Pope, M.A., F.R.S.

Treasurer: Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries: Samuel Smiles, D.Sc.; James Charles Philip, M.A., D.Sc., Ph.D.

Foreign Secretary: Arthur William Crossley, D.Sc., Ph.D., F.R.S.

Ordinary Members of Council: George Barger, M.A., D.Sc.; Edward John Bevan; William Robert Bousfield, M.A., K.C.; Adrian John Brown, M.Sc., F.R.S.; Harold Govett Colman, D.Sc., Ph.D.; Frederick George Donnan, M.A., Ph.D., F.R.S.; Arthur Harden, D.Sc., Ph.D., F.R.S.; Thomas Martin Lowry, D.Sc.; Hugh Marshall, D.Sc., F.R.S.; Kennedy Joseph Previt   Orton, M.A., Ph.D.; Sir Boverton Redwood, Bart., D.Sc.; Edward John Russell, D.Sc.

ANNIVERSARY DINNER.

The Anniversary Dinner of the Society was held at the Whitehall Rooms, Hotel Métropole, on Friday, March 14th, 1913, at 7.30 p.m., and the following Fellows and Guests were present:

- Abram, Mr. H. H.
 Applebey, Mr. M. P.
 Armstrong, Prof. H. E., *Past President*.
 Baker, Prof. H. B., *Vice-President-elect*.
 Barger, Dr. G.
 Beale, Sir W. Phipson.
 Beilby, Dr. G. T., *Past-President, Institute of Chemistry*.
 Bevan, Mr. E. J.
 Borns, Dr. H.
 Boys, Prof. C. V.
 Buchanan, Dr. J.
 Buckley, The Rt. Hon. Lord Justice.
 Cain, Dr. J. C., *Editor*.
 Cameron, Dr. H. C.
 Carr, Mr. F. H.
 Carr, Mr. S. E., *Assistant Secretary*.
 Chapman, Mr. A. Chaston.
 Chegwyn, Mr. Joseph.
 Cholmeley, Dr. H. P.
 Clifford, Mr. F. W., *Librarian*.
 Colman, Dr. H. G.
 Cooper, Mr. R. Elliott, *President, Institution of Civil Engineers*.
 Crossley, Prof. Arthur W., *Hon. Secretary, The Daily News, The Daily Telegraph, The*
 Dixon, Prof. Harold B., *Past-President*.
 Dobbie, Prof. J. J.
 Dyer, Dr. Bernard.
 Evans, Mr. U. R.
 Ewing, Sir Alfred, *Director, Naval Education*.
 Fairley, Mr. T.
 Findlay, Prof. A.
 Forster, Dr. M. O., *Vice-President*.
 Foster, Mr. H. Hylton, *Master, The Leathersellers Co.*
 Foucar, Mr. J. L.
 Frankland, Dr. E. P.
 Frankland, Prof. Percy F., *President*.
 Freundlich, Prof. H.
 Garnett, Mr. J. C. M., *Principal, Manchester Technical School*.
 Garnett, Mr. Kenneth.
 Godlee, Sir Rickman J., *President, Royal College of Surgeons*.
 Goulding, Dr. E.
 Gray, Dr. R. W.
 Green, Prof. A. G.
 Greenaway, Mr. A. J., *Sub-Editor*.
 Haas, Dr. P.
 Hacker, Mr. Arthur
 Hamilton, The Rt. Hon. Lord Justice.
 Hawksley, Mr. Charles, *Past President, Institution of Civil Engineers*.
 Henry, Dr. T. A.
 Hewett, Sir John P.
 Hewitt, Dr. J. T.
 Hill, Mr. C. A.
 Hiramatsu, Mr. T.
 Holland, Sir Thomas H.
 Hooper, Mr. E., *President, Institution of Mining and Metallurgy*.
 Hooper, Mr. E. Grant.
 Hooper, Major R. G.
 Howard, Mr. David, *Past President, Institute of Chemistry*.
 Humphrey, Mr. E.
 Jones, Prof. B. M.
 Kemp, Mr. W. J.
 Kennedy, The Rt. Hon. Lord Justice.
 Keogh, Sir Alfred, *Rector, Imperial College of Science and Technology*.
 Lapworth, Dr. A.
 Lessing, Dr. R.
 Le Sueur, Dr. H. R.
 London News Agency, *The*
 Lowry, Dr. T. M.
 MacAlister, Principal Sir Donald, *Vice-Chancellor, University of Glasgow*.
 MacEwan, Mr. P.
 McGowan, Dr. G.
 Macnab, Mr. W.
 Matthews, Dr. F. E.
 Meldola, Prof. R., *President, Institute of Chemistry*.
 Merriman, Mr. R. W.
 Messel, Dr. R.
 Mohr, Dr. B.
 Mond, Mr. E. S.
 Moody, Major-General Sir John M.
 Mordey, Mr. W. M., *Past-President, Institution of Electrical Engineers*.
 Morning Post, *The*.
 Müller, Dr. Hugo, *Past-President*.
 Nagel, Mr. D. H.
 Niemeyer, Mr. O. E.
 Oldfield, Mr. H. C. F.
 Perkin, Prof. W. H., *President-elect*.

- Perry, Prof. John, *Past-President, Institution of Electrical Engineers.*
 Philip, Dr. J. C., *Hon. Secretary-elect.*
 Pickard, Dr. R. H.
 Pilcher, Mr. R. B., *Registrar, Institute of Chemistry.*
 Pilley, Mr. J. J.
 Ping, Mr. W.
 Pope, Prof. W. J., *Vice-President.*
 Poulton, Prof. E. B., *President, Linnean Society.*
 Power, Dr. F. B.
 Prain, Lt.-Col. Sir David, *Director, Kew Gardens.*
Press Association, The.
 Pyman, Dr. F. L.
 Reynolds, Prof. J. E., *Past-President.*
 Rideal, Mr. E. K.
 Rideal, Dr. S.
 Rogerson, Mr. H.
 Rutherford, Prof. E.
 Salamon, Mr. A. Gordon, *Master, The Skinners Co.*
 Schuster, Prof. A., *Secretary, The Royal Society.*
 Scott, Dr. A., *Hon. Treasurer.*
 Shaw, Dr. W. N., *Director, Meteorological Office.*
 Sidgwick, Dr. N. V.
 Smiles, Dr. S., *Hon. Secretary.*
 Spielmann, Dr. P. E.
 Sprigge, Dr. S. S.
 Standard, *The.*
 Stead, Mr. W. H.
 Thomas, Mr. N. G.
 Thompson, Prof. Silvanus P., *Principal, Finsbury Technical College.*
 Thomson, Prof. J. M.
 Tilden, Sir William A., *Past-President.*
 Tilley, Mr. J. W.
 Tilley, Mr. V. J.
Times, The.
 Vasey, Mr. S. A.
 Watkins, Mr. E. J.
 Wayland, Major E. R.
 Wayland, Mr. W. A.
 Wells, Mr. H. G.
 Whitbread, Mr. F. P., *President, Institute of Brewing.*
 Willett, Mr. H. W. M.
 Wink, Mr. I. G. S.
 Wintle, Mr. Cyril, *Master, The Merchant Taylors Co.*
 Wolfe-Barry, Sir John, *Prime-Warden, The Goldsmiths Co.*
 Wrightson, Prof. J.
 Wynne, Prof. W. P.

LIST OF STEWARDS.

- Prof. H. E. Armstrong, LL.D., F.R.S.
 Prof. H. Brereton Baker, D.Sc., F.R.S.
 Sir W. Hipson Beale, Bart., K.C., M.P.
 Dr. G. T. Beilby, F.R.S.
 Mr. E. J. Bevan.
 Mr. W. R. Bousfield, M.A., K.C.
 Dr. J. C. Cain.
 Mr. A. Chaston Chapman.
 Dr. H. G. Colman.
 Prof. Arthur W. Crossley, D.Sc., F.R.S.
 Sir James Dewar, D.Sc., F.R.S.
 Mr. A. J. Dickinson.
 Prof. Harold B. Dixon, M.A., F.R.S.
 Prof. J. J. Dobbie, D.Sc., F.R.S.
 Dr. Bernard Dyer.
 Mr. T. Fairley.
 Dr. M. O. Forster, F.R.S.
 Mr. J. L. Foucar, B.Sc.
 Prof. Percy F. Frankland, LL.D., F.R.S.
 Mr. J. G. Gordon.
 Prof. A. G. Green, M.Sc.
 Mr. A. J. Greenaway.
 Dr. A. Harden, F.R.S.
 Dr. J. T. Hewitt, M.A., F.R.S.
 Prof. W. R. E. Hodgkinson, Ph.D.
 Mr. G. T. Holloway, A.R.C.S.
 Mr. E. Grant Hooper.
 Mr. W. J. Kemp.
 Dr. A. Lapworth, F.R.S.
 Dr. R. Lessing.
 Dr. H. R. Le Sueur.
 Dr. J. Lewkowitsch, M.A.
 Prof. A. Liversidge, LL.D., F.R.S.
 Dr. T. M. Lowry.
 Dr. G. McGowan.
 Mr. W. Macnab.
 Dr. A. McKenzie, M.A.
 Dr. F. E. Matthews.
 Prof. R. Meldola, D.Sc., F.R.S.
 Dr. R. Messel, F.R.S.
 Dr. Hugo Müller, F.R.S.
 Dr. J. C. Philip, M.A.
 Dr. R. H. Pickard.
 Prof. W. Jackson Pope, M.A., F.R.S.
 Sir William Ramsay, K.C.B., F.R.S.
 Sir Boverton Redwood, Bart., D.Sc.
 Prof. J. Emerson Reynolds, M.D., F.R.S.

Dr. E. J. Russell.	Dr. J. F. Thorpe, F.R.S.
Mr. A. Gordon Salamon.	Sir William Tilden, D.Sc., LL.D.,
Dr. Alexander Scott, M.A., F.R.S.	F.R.S.
Dr. Samuel Smiles.	Mr. W. A. Wayland.
Prof. J. Millar Thomson, LL.D.,	Prof. J. Wrightson.
F.R.S.	Prof. W. Palmer Wynne, D.Sc.,
Dr. L. T. Thorne.	F.R.S.

The following toasts were proposed :

BY THE PRESIDENT :

1. "HIS MOST GRACIOUS MAJESTY THE KING."
2. "THEIR MAJESTIES THE QUEEN AND QUEEN ALEXANDRA, HIS ROYAL HIGHNESS THE PRINCE OF WALES, AND THE OTHER MEMBERS OF THE ROYAL FAMILY."

BY THE RIGHT HONOURABLE LORD JUSTICE KENNEDY, P.C. :

3. "THE CHEMICAL SOCIETY," coupled with the name of *The President*.

BY PROFESSOR W. H. PERKIN, LL.D., F.R.S.,
President-Elect of the Chemical Society :

4. "LEARNED AND SCIENTIFIC SOCIETIES," coupled with the names of Sir RICKMAN J. GODLEE, Bart., M.D., F.R.C.S., *President of the Royal College of Surgeons*, and Professor E. B. POULTON, LL.D., F.R.S., *President of the Linnean Society*.

BY SIR WILLIAM A. TILDEN, D.Sc., F.R.S.,
Past President of the Chemical Society :

5. "THE GUESTS," coupled with the names of The Right Honourable LORD JUSTICE HAMILTON, K.C., and Mr. H. G. WELLS.

The Loyal Toasts having been honoured,

LORD JUSTICE KENNEDY, in proposing "The Chemical Society," said his one great regret was that he was truly and humbly conscious of his want of qualification to do justice to the toast. That disqualification was the absence of any knowledge of the great science which that Society had so successfully fostered and developed since its commencement in the year 1841. The necessities of his life had, unfortunately, compelled him to pursue a very different part from that of the study of the science which in the Chemical Society flourished and abounded. It was not often that law and science were so happily blended as they were in the case of the late Mr. Justice Grove, whose only regret, no doubt, after he was raised

to the Bench was that he had not every day to study some case in which the most obstruse problem of chemistry would be presented for his judgment. It was the one drawback of an otherwise entirely enjoyable position. Their Society was, he understood, what he might call a voluntary college of research. They owed nothing to Governmental aid or interference. Nor was their primary aim the development of particular industrial success. Standing, as that Society did, in the position of a great leader, no thinking man could but recognise most gratefully the work that the Society had typified and strengthened. From Faraday to Frankland had been an epoch of chemical triumphs. They were not primarily, he understood, engaged in developing particular branches of chemical work, applied to what one might call practical ends, but a research society such as that guided, encouraged, and strengthened the individual development of special societies. During the last eighty or ninety years in this country there had been a re-formation and an improvement in every sphere of human life, owing to the marvellous discoveries of chemical science. It was difficult to find one field in which our life had not been made different by it. Whether we looked at sea or land, at intercourse, at industrial development, at the factory, or the workshop, or the farm, we saw what chemistry had done to make things better for those engaged in those industries. To the ordinary layman, like himself, we needed only think one moment to realise that in our everyday life chemistry had made that life more comfortable and more enjoyable. Purer food, purer water, purer air, all the investigations and the successful investigations into the more mysterious causes of disease, which had provided a safeguard against some of the most frightful but, happily, as we now find, preventable causes of human misery—all these things were due to the development of chemical science. When we thought of all that, no one, he was sure, would fail to drink cordially the toast of the Society which embodied the research without which these particular improvements were impossible. The chemists might not have solved the problem which interested the alchemist of the middle ages. They might not have been able to find either the power of transmuting baser things into gold, or of finding the cure for old age and the discovery of eternal youth, but they had made by chemical research, and by marvellous discoveries, life not merely more endurable but happier, and they had prolonged life not merely as a life, but as a working and enjoyable life. Further than that might he venture to say that to some of them, at any rate, there was the view that in the marvellous possible discoveries which chemical science would bring to light we might be nearer the heart of the great mystery of all—life itself—

we might be nearer the exploration of that mysterious borderland which lay between organic and inorganic matter; we might be nearer, possibly, the discovery of the truth: that things supposed now to be separated were closely allied, and the inner things—the powers of thought and imagination and the transference of both—might be explained in harmony with our knowledge and our aspirations. If, at any rate, that Society went on working in the spirit in which its leaders had always worked, in setting before themselves the purpose of working, simply and straightforwardly, to find the truth by experiment and observation, we should yet find that the harvest of the past can be exceeded by the harvest of the future. They all believed that there lay before a Society like that, leadership in the search for truth in one of the most important realms of nature; and if the spirit of the past remained with those who worked in the future, they might be able, when assembling, as they were then doing, at some future date, to chronicle success of which that night they dare not dream—success which would have a real value, not merely in the material prosperity of our country, but in the development of the truth, for which all so earnestly longed, with regard to secret things as yet but guessed at. They knew that in many places in Scotland and in England, their chairman had done most valuable work, both as a searcher after truth and as a great and successful contributor to the material value of chemical science. When one looked at what he had done, one could see in him the embodiment of that Society, which worked for research, but which was never happier than when that research and the discovery which followed it were able to contribute to the practical happiness and the welfare of the community.

The PRESIDENT said it had been a great gratification to him to hear his Lordship speak not only with such appreciation of the Chemical Society, but also in such kindly terms of himself. The proposer of the toast referred to the Chemical Society from the outside. Perhaps he might be permitted to say a few words about the Society from the inside. The Society was the oldest chemical society in the world, and although they had now exceeded the age of three-score years and ten, he did not think they exhibited much of the decrepitude associated, often most erroneously, with advanced age. He did not propose to boast of the age of their Society, which was nothing if not progressive. It was far better to see how they stood and were likely to stand in the future than to dwell over-much on the glories of the past. He thought they might be assured of this: that they numbered amongst their living fellows several great masters who could count amongst their exploits what were undeniably some of the most brilliant discoveries that had ever

been made by man. Nor need they fear for the future prestige of their Society when they saw an ever-increasing enthusiasm for research among the younger generation of their Fellows who were gaining distinction, many of them, in every branch of chemical science. But the progress of chemistry did not depend solely upon the efforts of their Fellows, for whilst during the past twenty years so many chemists had become physicists, quite recently the tables had been turned, and physicists were becoming chemists. That eminent physicist, Sir Joseph Thomson, had entered the field of analytical chemistry, and had invented an absolutely new system of chemical analysis. There was also Prof. Strutt with his "active nitrogen," whilst Prof. Rutherford, in his wonderful researches on radioactivity, had revealed the existence of a whole series of new elements. Those eminent physicists had discovered, what chemists had long known, that the science was the most exacting of mistresses, making more imperious demands on the time and patience of her votaries than any of her sisters. Chemistry was also the science of which the aim, scope, and method were least understood, not only by the general public, but by that august assemblage of persons who styled themselves "the cultivated classes." Owing to this widespread absence of knowledge of chemistry—to which the proposer of the toast had pleaded guilty—the public were particularly liable to be misled by sensational statements which appeared from time to time in the Press. Only a few short months ago they were credited with being on the eve of the discovery of the synthesis of life itself; and still more recently there was the startling announcement that chemists were now able to manufacture matter out of ether or out of electricity. He did not think they had any cause to complain of the position they filled in the public eye when such divine powers as these were ascribed to them. They had proverbial authority for saying that where there was smoke there was fire, and the mere fact that such statements were made showed how far they had travelled since the Society was founded seventy-two years ago. They had indeed, during recent years, made astounding strides in their knowledge of the chemistry of life, and had also come to extraordinarily close quarters with the atoms and molecules of which matter was made up. When they considered that accurate and systematised chemical knowledge only went back for a little over one hundred years, what might not another century of investigation bring forth? It used to be a favourite theme, and a favourite practice with past Presidents of the Society to refer to the lack of encouragement given to investigators in this country, and to point out the indifference and apathy of our rulers towards science and matters connected

with science in general. He did not think that subject required labouring, for he believed everyone present would agree, after the object lessons we had had, that there could be no sort of doubt as to what was likely to be the fate of any country in which science was persistently neglected and treated in a step-motherly fashion. Some years ago a society was formed for the sole purpose of impressing on those in authority how great were the perils which surrounded their self-complacent indifference towards matters connected with science. He was sure the Chemical Society wished all success to the British Science Guild, which had taken upon itself that difficult and Sisyphean task. Regrettable as, no doubt, was the attitude of our actual rulers towards most matters connected with science, there were signs that our would-be rulers were turning their attention to chemical phenomena. More especially in those attacks which now imperilled our correspondence—and which, he had reason to believe, had led to several invitations to that dinner failing to reach their destinations—they had read of the employment of a spontaneously inflammable liquid, the first accounts of which suggested that some subtle organic chemical—possibly zinc methyl—was being employed by these hysterical and deluded malefactors. It was therefore a relief to learn that more accurate investigation showed that no such profound knowledge of chemistry was involved, but that only phosphorus, the properties of which a learned judge and jury had declared to be the common knowledge of every school-boy, was being degraded to such nefarious and deplorable uses. It was this abuse of chemical knowledge in all ages which had sometimes led to the belief that chemists were working in partnership with the Prince of Darkness himself. But their Society could not be charged with being privy to any such sinister acts, because it was not concerned with any of the applications of chemistry, but only with the progress of chemical knowledge. The progress of chemical knowledge they assisted by means of their scientific meetings, their Research Fund, and especially by means of their publications, which consisted of volumes of Transactions, Proceedings, Abstracts, and Annual Reports, the whole constituting a living record of chemical discovery from year to year. Just as they were the pioneers in the formation of a chemical society, so they had been the pioneers in certain matters connected with scientific publication. He believed they were the first society to supply abstracts of all publications of chemical interest throughout the world. Their annual reports, again, had been of priceless value to their Fellows. He believed he was right in supposing that chemical literature was more perfectly organised than the literature of any other science, and that their nomenclature transcended in clearness of language and terseness anything that

had yet been invented. But chemists had determined further to improve their nomenclature, and the labours of the International Association of Chemical Societies would be very greatly lightened if they could accept the opinion of that eminent French physical chemist, M. Le Chatelier, who had asserted that he did not believe that more than a small fraction of the so-called organic compounds had any existence whatsoever excepting in the imagination of their alleged discoverers. It would appear that the great obstacle with which the progress of science was destined to be confronted in the future was the impossibility of integrating the immense amount of knowledge gained by individual investigators. There was much evidence that even the ablest men in one branch of science were often quite unable to form a clear and sound understanding of what another branch were engaged in. For that, it would appear, they must wait for some chance mutation in the evolution of the human faculties which would provide them with some superman capable of co-ordinating and utilising the enormous wealth of information and knowledge which had been accumulating in the separate and almost watertight compartments into which science had now become divided, and in which the several groups of investigators were working in close and solitary confinement. He concluded by expressing regret at the loss by death during the past year of Dr. Divers, who was the apostle of modern chemistry in the Far East, and of Dr. Wade and Dr. Jones, who were struck down under such tragic circumstances. He thanked the Society for the great honour they had conferred upon him in permitting him to occupy the chair which had been filled by such eminent predecessors. They all wished Prof. Perkin (the President-elect) not only success in the presidential chair, but also a long and brilliant career in the chair to which he had so recently been called in the University of Oxford.

Prof. W. H. PERKIN proposed "Learned and Scientific Societies." He said members of the Chemical Society had always gratefully recognised the results of the work of other learned societies in so many branches of science, and he thought it might well be said that every learned society reacted on and stimulated the other learned societies. Chemists owed a debt of gratitude to the Royal and Chemical Societies, more especially for the financial assistance received in connexion with their investigations, and without which many of their researches could hardly have been attempted. They hoped that wise and generous donors would be found in the near future who would augment the insufficient funds at the disposal of the learned societies, and would thus enable them to do still more for research.

Sir RICKMAN J. GODLEE, in response, said in the last fifty years

chemistry had made strides at least as great as those of his profession, and surgeons were almost, if not quite, puzzled by the number of new substances, drugs, and chemical compounds that were being launched upon them. Radium, he supposed, was the substance beyond all the rest which had given rise to great searching of heart amongst them. In their treatment by radium they were met by the most irregular results, and they must wait and hope that more would be known about it in the future. He expressed the opinion that chemical nomenclature very much confused the medical student.

Prof. E. B. POULTON also briefly acknowledged the toast.

Sir WILLIAM A. TILDEN proposed "The Guests."

Lord Justice HAMILTON, in response, said he belonged to a profession which occupied its time in peering, with blear-eyed gaze, into the work of those in the past who framed immutable laws for the government of the present. We had come to the time, however, when we appreciated that the laws of England changed remarkably fast, and it was some consolation to know that the laws of science, in the hands of chemists, appeared to be passing through the same change. Although the guests came there, representing every possible occupation and unanimous in their sympathy with chemistry, and interested with chemists in their sacrifices for science, he did not suppose that the members of the Chemical Society quite recognised how little the outsider knew about chemistry, and sometimes how little he cared about it. He himself was once being coached in one of the ologies, for the purpose of a case, and he found in the proof of one of his experts something about molecules. So he said to the learned gentleman who was assisting him, "What are molecules?" He replied, "They are just a term we use when we are talking about what we don't understand." A great deal had been said about the importance of chemistry to the human race, and about the blessings it had conferred on the human race. But was it not a fallacy to suppose that chemistry existed for the improvement of the human race, or that the desire of the chemist was to benefit mankind? Of course, the chemist desired to keep his wife and family in comfort, but what concern had he with the human race at large? Was it his business to make chemical champagne or chemical cheese? What the chemist wanted was not to improve the human race, but to know more chemistry. Incidentally he believed that if they knew more and more chemistry, it did more good to other people. He ventured to suggest that the attitude of the true chemist towards the improvement of this human race might be expressed in the language a noble lord once used with regard to "the consequences." His business was not to invent new forms

of pure air or pure water, or complications of that kind. His business was to know more, to add to the sum of human knowledge, and if he then passed away into the infinite he would know the unknowable, and with that he would be content.

Mr. H. G. WELLS also replied. He complained of the obscurity that had fallen upon the atom since his student days. He said he wished chemists would make things clearer to those who lived in the darkness outside their Society. He could not help asking: Did they realise how wonderful a thing their science was? Science to him had always been the true romance. The beleaguered castle and the beautiful damsel had always seemed to him small incidental stuff beside the great fantasia of scientific possibilities. Again and again in his novels he had tried to make the scientific man his hero. Did they realise that science, as we understood it, was a new thing? It was something absolutely new in human affairs. In the last 200 or 300 years it was something which had been added to human life, something which gave permanent results, and was continually growing. There was only a little band of men who were doing this scientific work and adding to this strange new body of knowledge, a band which numbered, at a generous estimate, considerably less than five thousand. And yet that little band, it appeared to him, was rapidly changing all the conditions of human life. Discussing the effect of chemistry upon war, Mr. Wells said that during the last thirty years the whole of Europe had been arming, and chemists had been putting weapons into the hands of the warrior. And now the warrior, armed with the weapons which they chiefly had given to him, was afraid to let them off because he realised that he would blow the whole fabric of civilisation to pieces. Chemists had not, perhaps, made war impossible, but they had made it preposterous. Almost at any time, too, chemists might be flinging great chunks of synthetic gold into a world, whose whole economic order might be upset by the feat. When he thought of all these things his admiration for their work tottered into a kind of terror. He felt that either this rapid alteration of every material condition of life must stop, or else other things, economic ideas, social ideas, legal conceptions, must rouse themselves to keep pace with it.

Thursday, April 3rd, 1913, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society through death on March 29th, 1913, of Mr. John Heron, who was elected a Fellow on June 15th, 1876.

Messrs. Percy C. Burr, J. A. Christie, and E. A. Buckle were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

John Percy Batey, M.Sc.Tech., 3, Minorca Road, Weybridge.
George Frederick William Blackburn, 25, Rowington Road, Norwich.

Arthur Hawker Cox, 4, St. Peter's Place, Brighton.

Arthur Ernest Crutchley, 230, Albert Road, Handsworth, Birmingham.

Vasanji Premji Dalal, M.A., B.Sc., "Gnana Geha," Central Hindu College, Benares.

Percy Hutchinson, B.Sc., 74, Hotham Road, Putney, S.W.

Joseph Stuart Lawson, 18, Old Swan Lane, E.C.

Harold Charles Lloyd, B.Sc., Ferndale, Trinity Square, Llandudno.

John Robert Ruffley, 130, Worsley Road, Farnworth, Lancs.

Herbert Sutcliffe Shrewsbury, Government Laboratory, Trinidad, B.W.I.

Panks James Wigginton, 54, Grand Parade, Brighton.

William John Young, M.Sc., D.Sc., Australian Institute of Tropical Medicine, Townsville, N. Queensland.

Of the following papers, those marked * were read:

- *77. "Studies in the camphane series. Part XXXIV. Configuration of the eight oximino-derivatives of camphorquinone." By Martin Onslow Forster.**

Based on the recognition of stable *isonitrosocamphor* as the *syn*-modification (T., 1905, 87, 232), the properties of the two forms of *isonitrosoepicamphor* and of the four camphorquinone-dioximes have been reviewed in such a way as to suggest the configuration of the eight oximino-derivatives of camphorquinone. The scheme thus elaborated agrees in every detail with the experimental relationship between the four monoximes and the four dioximes.

- *78. "The action of ozone on cellulose. Part III. Action on beech wood (lignocellulose)." By Charles Dorée and Mary Cunningham.**

In continuation of previous work on the simple lignocellulose jute (T., 1912, 101, 503), the action of ozone on the more complex tissues of the woods has been examined. In the presence of

moisture, ozone rapidly attacks the wood substance, producing carbon dioxide and acidic substances. Results were given showing the production of these per hour from one to twelve hours. As the result of oxidation with ozone a considerable proportion of the wood is converted into derivatives soluble in water; after twelve hours the loss in weight is some 40 per cent. The water-digest contains acetic, formic, and other reducing acids, and yields furfuraldehyde. Vanillin was not detected. The properties of a wood residue obtained after thirty hours' treatment were given in detail. This contained one-half of the furfuraldehyde-yielding groups, but only one-third of the methoxyl groupings of the original wood. The results are well explained by the formulation of the lignone complex given by Cross and Bevan ("Researches on Cellulose," III., 104), but they do not lend support to the coniferyl alcohol formula proposed by Klason.

DISCUSSION.

Mr. C. F. Cross desired to state that he had followed these investigations, and considered that they established the value of the authors' method as one of progressive constitutional dissection of the lignocellulose. With a general verification of the schematic formula for lignone in "Researches on Cellulose;" III. (Cross and Bevan), the results further weakened the case for the formulæ proposed by Klason and Czapek.

*79. "The formation of cyclic compounds from derivatives of 2:2'-ditolyl." By James Kenner.

The appearance of a paper by Weitzenböck (*Monatsh.*, 1913, **34**, 193) has necessitated publication of results obtained by the author in continuation of previous work (Kenner and Turner, T., 1911, **99**, 2101; Kenner, P., 1912, **28**, 187). The results obtained have rendered the more important derivatives of dibenzocycloheptadiene accessible by the usual reactions.

Thus the *hydrazide* of *dibenzocycloheptadienecarboxylic acid*, needles, m. p. 176°, has been converted into *dibenzocycloheptadienylurethane*, small prisms, m. p. 88°, from which the *hydrochloride* of 1-amino-3:5-dibenzo- $\Delta^{3:5}$ -cycloheptadiene, needles, m. p. 287°, is obtained by hydrolysis with concentrated hydrochloric acid. The amine also results when the oxime of dibenzocycloheptadienone is reduced in alcoholic solution with sodium, and has been further characterised by its *platinichloride*, a canary-yellow precipitate, m. p. 266°, and its *acetyl* derivative, needles, m. p. 147°. When dibenzocycloheptadienylamine hydrochloride is distilled, it yields

3:5-dibenzo- $\Delta^{1:3:5}$ -cycloheptatriene, the *picrate* of which forms copper-coloured needles, m. p. 137°.

Further, *diethyl 2:2'-ditolyl- $\omega\omega'$ -dicarboxylate*, rhombic crystals, m. p. 49°, is readily converted in boiling benzene solution under the influence of sodium into *ethyl 3:5-dibenzo- $\Delta^{3:5}$ -cycloheptadien-1-one-2-carboxylate*; this compound gives an indigo-blue coloration with ferric chloride, and yields a dirty green *copper* salt, m. p. 253°, when its ethereal solution is shaken with aqueous copper acetate solution.

DISCUSSION.

Mr. JOHN H. CHRISTIE suggested that if the two outside carboxyl groups of the diphenyltetracarboxylic acid were esterified, it might be possible to cause anhydride-formation between the two inner carboxyl groups, with formation of a seven-carbon ring instead of two five-carbon rings.

Dr. KENNER, in reply, said his calculation of the strain in the dibenzocycloheptadiene ring had only been carried out on the assumption that all its carbon atoms were coplanar. Experiments, similar to those suggested by the President, had been carried out, and were described in the full communication (compare P., 1912, 28, 187). The various di-ester acids of diphenyltetracarboxylic acid were receiving attention, but the experiments in this direction were only in their initial stage.

*80. "The new oxide of carbon, mellitic anhydride, and derivatives of mellitic acid." (Preliminary note.) By William John Jarrard.

In view of the preparation of a new oxide of carbon by Hans Meyer and Steiner (*Ber.*, 1913, 46, 813) and the statement that the results of further work on mellitic acid will shortly be published, the following preliminary account of the work done by the author on this compound and other derivatives of mellitic acid during the past two years was communicated.

Publication of these results was delayed on account of the somewhat laborious method of preparing the mellitic acid, by the oxidation of carbon by nitric acid and potassium chlorate, precipitation of the barium salt, and fractional crystallisation of the ammonium salt, no commercial source of mellitic acid being then available.

The two anhydrides of mellitic acid have been obtained by methods differing from those used by Hans Meyer and Steiner.

A dianhydride was obtained by dissolving mellitic acid in fuming sulphuric acid (containing 70 per cent. of sulphur trioxide), and slowly adding water. The dianhydride is precipitated as a white, amorphous, hygroscopic powder, separating from solutions in ether

or acetone in crystals containing these solvents. The crystals from acetone contain one molecule of acetone of crystallisation, and decompose on keeping. This anhydride gives characteristic colour reactions when heated with nitrobenzene, naphthalene, or phenanthrene.

The trianhydride, $C_{12}O_9$, was prepared by the action of thionyl chloride on carefully dried silver mellitate suspended in ether or benzene (Denham, P., 1909, 25, 294). An intermediate compound is formed, which is decomposed completely with the elimination of sulphur dioxide only after continued boiling. The dianhydride is always produced at the same time, probably owing to the formation of mellitic acid from the silver mellitate by hydrogen chloride, which is retained in thionyl chloride with great persistency. By fractional sublimation of the product of the reaction in a vacuum there may be separated the dianhydride, pyromellitic anhydride, and a substance which gives the same colour reactions with nitrobenzene, naphthalene, and phenanthrene as the oxide prepared by Hans Meyer and Steiner, and which acts as the trianhydride of mellitic acid on titration with baryta solution. The formation of pyromellitic anhydride, which probably results from the decomposition of the dianhydride, confirms the formula suggested by Hans Meyer and Steiner for the latter substance.

Although sufficient of the pure trianhydride for a complete analysis has not yet been obtained, this compound was completely identified by the formation of a *triethyl* ester of mellitic acid (m. p. 165° with decomposition) by the action of ethyl alcohol on the crude substance. Ethyl alcohol does not act very readily on this anhydride, the action being complete only after boiling the mixture for some time. Methyl alcohol, however, reacts much more readily. All the common inorganic salts of this triethyl ester are soluble in water. The *sodium*, *barium*, and *silver* salts have been prepared by precipitation in alcoholic solutions and analysed.

When heated in a vacuum the triethyl ester does not form the trianhydride, as might be expected. It melts at 140°, loses one molecular proportion of ethyl alcohol, and forms the monoanhydride of a diethyl ester of mellitic acid (octahedral crystals from ethyl acetate, m. p. 143—144°). On further heating, one molecular proportion of carbon dioxide is liberated, and an anhydride of a diethyl ester of benzenepentacarboxylic acid results (leaflets softening at 210°, and melting completely at 235°).

Rhead and Wheeler (T., 1913, 103, 461) have recently brought forward evidence that during the combustion of carbon in oxygen, an oxide of carbon is formed, which breaks up into carbon monoxide and carbon dioxide, and suggest that this compound is similar to mellitic acid or its trianhydride.

In this connexion it is of interest to note that these gases are obtained when the vapours from mellitic acid or the crude anhydride are passed through a hot tube in an atmosphere of nitrogen free from oxygen.

The following derivatives of mellitic acid have been prepared, and are at present under investigation: the *trimethyl* ester from the trianhydride, the *trimethyl triethyl* ester (prisms, m. p. 65°), the *triamide*, corresponding with the triethyl and trimethyl esters, and *hexa-amide* (a white, amorphous powder, m. p. above 300°, which turns bright blue on exposure to light, but loses this colour when placed in darkness).

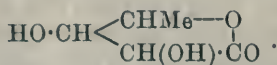
The ultraviolet absorption spectra of alcoholic solutions of mellitic acid and its hexamethyl and hexaethyl esters have been examined at various dilutions. These solutions exhibit strong general absorption, but no selective absorption.

81. "Synthesis of a methyl tetrose." (Preliminary note.)

By Robert Gilmour.

In view of the fact that no synthesis of a methyl pentose has been recorded (with the exception of the recent synthesis by Fischer from glucose triacetyl bromohydrin, which appeared after the work described in this note had been started), it seemed of some importance to attempt the preparation of such a compound.

The most suitable material from which to start appeared to be the dihydroxyvalerolactone, which had been prepared by Thiele (*Annalen*, 1902, **319**, 194) by the oxidation of β -angelicalactone with potassium permanganate, and which he considered to possess the structure:



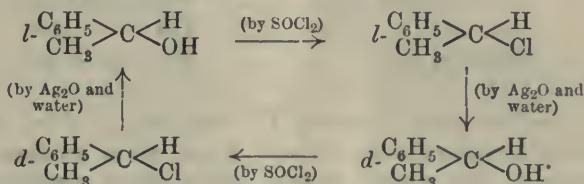
On the analogy of the sugar lactones this substance ought to yield a methyl tetrose on reduction with sodium amalgam. From the product of reduction an osazone was isolated, which proved to be a *methyl tetrosazone*.

The compound forms yellow, microcrystalline needles, very sparingly soluble in water or ether, but readily so in alcohol, and melts at 140–142°. It must be regarded as the osazone of an inactive methyl tetrose.

Unfortunately, the preparations of the dihydroxyvalerolactone in quantity is a laborious and tedious process, and the yield is small. It is proposed, however, to carry the synthesis a stage further, in order to obtain, if possible, a methyl pentose. The resolution of dihydroxyvalerolactone is also contemplated with a view to the isolation of the sugars in an optically active condition.

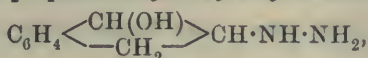
82. "Experiments on the Walden inversion. Part IX. Interconversion of the optically active phenylmethylcarbinols." By Alex. McKenzie and George William Clough.

It was shown that the optically active phenylmethylcarbinols can be interconverted according to the scheme:



83. "Externally compensated hydroxyhydrazinohydrindene, its derivatives and resolution into optically active components." By David Henry Peacock.

The author has prepared *l*-hydroxy-2-hydrazinohydrindene,



by the action of hydrazine hydrate on bromohydroxyhydrindene, and has resolved it into optically active components with the aid of *d*-tartaric acid. Several salts and derivatives of the externally compensated and optically active hydrazine were described.

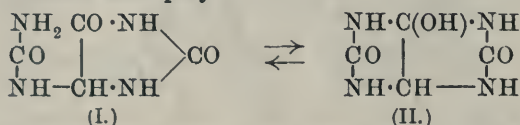
84. "Studies in substituted quaternary azonium compounds containing an asymmetric nitrogen atom. Part I. Resolution of phenylmethylethylazonium iodide into optically active components." By Bawa Kartar Singh.

The author has prepared externally compensated *phenylmethylethylazonium iodide*, $(\text{C}_6\text{H}_5)(\text{C}_2\text{H}_5)(\text{CH}_3)(\text{NH}_2)\text{NI}$, and has obtained salts of the corresponding laevorotatory azonium compound with the aid of *d*-camphor- β -sulphonic, *d*-tartaric, and *d*-camphoric acids. The *l*-azonium radicle contained in the compounds described readily undergoes racemisation.

85. "The constitution of allantoin." By Arthur Walsh Titherley.

Allantoin, in spite of the accepted unsymmetrical formula (I), proposed by Grimaux, functions as a symmetrical compound in regard to its alkyl derivatives, and only two methyl derivatives (α and β) appear to be capable of existence. Further, Mendel and

Dakin (*J. Biol. Chem.*, 1910, 7, 153) pointed out that, in spite of the asymmetric carbon atom in formula I, allantoin cannot be obtained in an optically active form. The author reconciles these and other contradictory features of allantoin with Grimaux's formula by supposing tautomerism, producing the symmetrical ring form (II), to come into play:



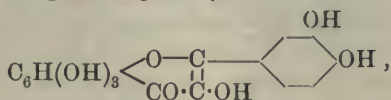
Such tautomerism involving the wandering of an amidic or hydroxylic hydrogen atom in such a way as to produce either an open-chain or ring system, is analogous to the "metoxazone tautomerism" observed by the author among acyl derivatives of salicylamide. All the facts relating to allantoin and its derivatives appear to be in harmony, with the supposition that formula II represents the pseudo-form of allantoin and formula I its normal constitution.

86. "Gossypetin." By Arthur George Perkin.

Gossypetin, $\text{C}_{15}\text{H}_{10}\text{O}_8$ (T., 1899, 75, 826; 1909, 95, 1855, 2181) exists as glucoside in the ordinary Indian cotton flower, *Gossypium herbaceum*, in conjunction with quercetin. *Gossypetin hexamethyl ether*, $\text{C}_{15}\text{H}_4\text{O}_2(\text{OMe})_6$, colourless needles, m. p. 170—172°, can be prepared by means of methyl iodide, and when hydrolysed with alcoholic potassium hydroxide gives protocathechuic acid dimethyl ether and *gossypitol tetramethyl ether*, $\text{C}_{12}\text{H}_{16}\text{O}_6$, needles, m. p. 115—116°. *Gossypetin hexaethyl ether*, $\text{C}_{15}\text{H}_4\text{O}_2(\text{OEt})_6$, m. p. 144—146°, in a similar manner gives protocathechuic acid diethyl ether and *gossypitol tetraethyl ether*, $\text{C}_{16}\text{H}_{24}\text{O}_6$, m. p. 110—111°. The latter yields the oxime, $\text{C}_{16}\text{H}_{25}\text{O}_6\text{N}$, m. p. 127—129°, with permanganate an acid, $\text{C}_{14}\text{H}_{18}\text{O}_7$, m. p. 154—155°, probably *hydroxytriethoxybenzeneglyoxylic acid*, and there is little doubt that it possesses the constitution $\text{HO} \cdot \text{C}_6\text{H}(\text{OEt})_3 \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{OEt}$.

With alcoholic *p*-benzoquinone, or by alkaline oxidation, gossypetin gives *gossypitone*, $\text{C}_{15}\text{H}_8\text{O}_8$, dull red, microscopic needles, soluble in dilute alkali with a blue colour, and this reaction also occurs during the dyeing operation when mordanted wool is employed. Gossypitone is a quinone, and with sulphurous acid is reconverted into gossypetin, but is not identical with the quercetone described by Nierenstein and Wheldale (*Ber.*, 1911, 44, 3487). Whether gossypitone is to be regarded as an "anthocyanin" (compare Wheldale, *Proc. Roy. Soc.*, 1909, B, 81, 44), and indirectly

responsible for the red of the cotton petal (such as that of *G. arboreum*), is considered uncertain, although a reddish-violet, crystalline compound can be obtained from the gossypetin glucoside. To gossypetin the constitution of an hexahydroxyflavone isomeric with myricetin and quercetagenin (T., 1913, **103**, 212) is assigned :



but as in the case of the latter colouring matter the position of the hydroxyls in the tetrahydroxybenzene nucleus remains undecided.

87. "The alleged permeability of glass to halogen vapours."

By James Brierley Firth.

Landolt (*Zeitsch. physikal. Chem.*, 1906, **55**, 589), in his experiments on the conservation of weight in chemical reactions, always obtained a slight loss. He concludes that this loss may be due to the escape of vapours through the walls of the containing vessel.

In later experiments (*Sitzungsber. K. Akad. Berlin*, 1908, 354) he shows that the loss may be due to the development of heat, causing a change in the amount of water condensed on the sides of the vessels, and also a slight change in volume of the vessel due to change of temperature and pressure. After making these allowances, Landolt concludes that there is no loss of weight during chemical reaction.

Zengelis (*Zeitsch. physikal. Chem.*, 1909, **65**, 341) describes experiments, from which he concludes that various vapours can readily pass through glass. He took a series of air-tight flasks, sealed with paraffin, containing respectively chlorine, bromine, and iodine; on the outside of these flasks a piece of silver foil was fixed, and then enclosed in separate air-tight vessels. The silver was found to be distinctly attacked after the following periods: (a) chlorine, 50 days; (b) bromine, 50 days; (c) iodine, 3 days.

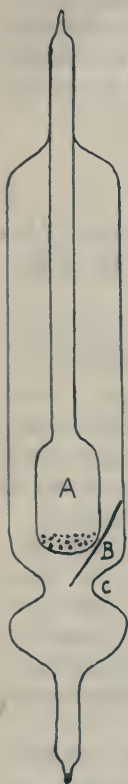
The effect was more rapid when the outer vessel was exhausted.

Zengelis concludes that in Landolt's experiments there is always a real loss of weight, and explains the loss as being due to the escape of the various vapours through the walls of the containing vessel.

Stock and Heyneman (*Ber.*, 1909, **42**, 1800) were unable, in the case of iodine, to confirm Zengelis's results even after three months.

Zengelis (*Zeitsch. physikal. Chem.*, 1910, **72**, 425) repeated his experiments, and endeavoured to determine the loss in weight, but his results were irregular.

The author has endeavoured to repeat Zengelis's experiments with a somewhat modified form of apparatus (see Fig.). It consists essentially of a thin bulb *A*, which contains the halogen, and an outer jacket, which contains a piece of bright, clean, silver foil, *B*, held in position by constriction *C*. The whole apparatus was made from ordinary soft glass tubing.



The conditions of experiment were varied as follows: (1) Outer and inner tubes full of air at atmospheric pressure, and at the room temperature; (2) outer tube vacuous, the inner tube as in (1); (3) inner tube vacuous, the outer tube as in (1); (4) outer and inner tubes vacuous.

Bulb *A* contained in one series a small quantity of pure iodine, and in a second series pure bromine. A number of pieces of apparatus, as described above, were made, and allowed to remain at room temperature. They were carefully examined periodically, and after a period of two years there was not the slightest indication of the presence of any silver haloid on the surface of the silver.

Another series of experiments was made, in which the tubes were heated for a period of fifty days at 360° , and then allowed to remain for two years, and in this case also no halogen had penetrated the glass.

The above experiments show that ordinary glass is not permeable to the vapours of iodine and bromine at 360° after fifty days, and after two years at the ordinary temperature.

88. "Preparation of amine nitrites."

By Pañchañan Neogi.

In continuation of the author's work on the isolation of ammonium nitrite (Neogi and Adhicory, T., 1911, **99**, 116) and conium nitrite (Neogi, T., 1912, **101**, 1608) from mixtures of the hydrochlorides of the bases and sodium or potassium nitrite, the following nitrites have been prepared in a similar manner: benzylammonium nitrite, methylammonium nitrite, ethylammonium nitrite, dimethylammonium nitrite, piperidinium nitrite, diethylammonium nitrite, trimethylammonium nitrite, triethylammonium nitrite. The general method of preparation consists in steam distillation in a vacuum. In the case of those nitrites, however, which sublime in a vacuum when heated, they have been prepared by vacuum

sublimation also. The actual isolation of these amine nitrites from mixtures of their hydrochlorides and alkali nitrites amply confirms the theory advanced by the author (P., 1911, 27, 242; T., 1912, 101, 1610) that an amine nitrite is an intermediate compound in the well-known reaction between nitrous acid and the primary, secondary, and tertiary amines, the purely aromatic amines being excepted.

89. "A criticism of some recent viscosity investigations."

By Eugene C. Bingham.

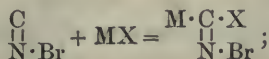
The use of viscometers of the Ostwald type for measuring the viscosity of liquids where the viscosities extend over a considerable range of values has led observers to unsatisfactory results. The reason is that in this form of apparatus the pressure is not variable at will, and therefore the neglected kinetic energy correction becomes very large with very fluid substances; with more viscous substances the time of flow is inconveniently great, and, as a result of the sluggish flow, the danger of partial clogging of the capillary becomes imminent. The prevalent idea that a kinetic energy correction is not applicable to viscometers of the Ostwald type is erroneous.

In interpreting the results of viscosity measurements, the old assumption is still being made without supporting evidence that the viscosities of homogeneous mixtures of liquids are additive. Since this omission is made in the face of abundant evidence that fluidities—and therefore necessarily not viscosities—are additive, the subsequent reasoning loses its cogency.

90. "Cyanogen and cyanogen bromide."

By Augustus Edward Dixon and John Taylor.

Although cyanogen bromide is not ionised by water, its aqueous solution reacts with a number of ionised substances. In most cases (if not in all) the primary change is due to combination of the cyanogen with the more electropositive ion, the bromine taking the less electropositive; secondary action, however, may occur amongst the products. These phenomena may be explained by the supposition that additive compounds are first produced by union of the ions, M and X, with the unsaturated carbon atom, the less electropositive, X, taking up the *syn*-position with respect to the bromine, thus:

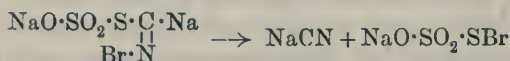


whereupon, decomposition follows, into $M \cdot CN + X \cdot Br$. The latter may now act on the cyanide, or other attackable material present (including sometimes MX itself), or may decompose; for example, with alkali hydroxide, cyanide and hypobromite are formed; these react, yielding cyanate and bromide; but if carbamide is present the hypobromite attacks it, and nitrogen escapes.

With hydrogen sulphide, if much free hydrochloric acid is present, the products are hydrogen cyanide, hydrobromic acid, and sulphur:



In the absence of free acid, much thiocyanic acid is formed, probably through the change $HCN + HSB r = HSCN + HBr$. With sodium thiosulphate a complex reaction occurs, which is thus explained:



and $NaO \cdot SO_2 \cdot SBr + NaS \cdot SO_2 \cdot ONa = Na_2S_4O_6 + NaBr$. The cyanide now reacts with the tetrathionate, producing sulphite, sulphate, and thiocyanate.

Thiocarbamide and cyanogen bromide, in the presence of sodium hydrogen carbonate, yield thiocyanate, bromide, and cyanamide; but in presence of a strong acid give hydrogen cyanide, hydrobromic acid, and a salt of formamidine disulphide.

For cyanogen the authors suggest, as preferable to the formula, $N:C:C:N$, usually adopted, the ring formula, $\begin{array}{c} C=C \\ | \quad | \\ N-N \end{array}$.

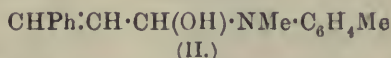
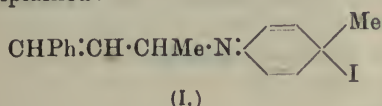
**91. "The spectroscopic investigation of the carbinol-ammonium base isomerism. Part II. Derivatives of cinnamylidene-*p*-toluidine."
By Charles Kenneth Tinkler.**

The action of methyl iodide and of methyl sulphate on cinnamylidene-*p*-toluidine has been investigated with a view to the preparation of a stable quaternary salt of an azomethine base. Additive compounds were obtained, but on crystallisation from alcohol the corresponding hydriodide and methyl hydrogen sulphate were obtained. These additive compounds are decomposed by water, soluble base, or soluble cyanide, and in this respect resemble the methiodide and ethiodide of benzylidene-*p*-toluidine described by Hantzsch and Schwab (*Ber.*, 1901, **34**, 837).

The ultra-violet absorption spectra of alcoholic solutions of the quaternary salts of cinnamylidene-*p*-toluidine containing soluble

base or cyanide are in agreement with those of the parent base, and are quite distinct from those of α -*p*-toluidino- γ -phenylisocrotononitrile, $\text{CHPh}:\text{CH}:\text{CH}(\text{CN})\cdot\text{NH}\cdot\text{C}_6\text{H}_4\text{Me}$, with which they would be in agreement if a ψ -base or cyanide were produced.

The salts of cinnamylidene-*p*-toluidine are much darker in colour than the parent base, and in this respect resemble the hydrochlorides of azomethine bases described by F. G. Pope and Fleming (T., 1908, 93, 1904) and by F. J. Moore and co-workers (*J. Amer. Chem. Soc.*, 1908, 30, 394, etc.). These investigators assign a quinonoid constitution to these salts. It will be observed that by assigning such a constitution to cinnamylidene-*p*-toluidine methiodide (I), the non-formation of a carbinol (II) from this substance would be readily explained:



Cinnamylidene-p-toluidine (m. p. 83°) was prepared in the usual manner. The *hydrochloride* (m. p. 188—190°), *hydrobromide* (m. p. 206°), *hydriodide* (m. p. 183°), *nitrate*, *hydrogen sulphate* (m. p. 193°), and *methosulphate* (m. p. 205°) were prepared for investigation in connexion with Hantzsch's theory of chromo-isomerism (*Ber.*, 1911, 44, 1783).

α -*p*-Toluidino- γ -phenylisocrotononitrile (m. p. 119°) was prepared by the condensation of cinnamaldehydecyanohydrin and *p*-toluidine, and also by the action of anhydrous hydrogen cyanide on cinnamylidene-*p*-toluidine.

92. "The influence of colloids and fine suspensions on the solubility of gases in water. Part III. Solubility of carbon dioxide at pressures lower than atmospheric." By Alexander Findlay and Thomas Williams.

The solubility of carbon dioxide in solutions of ferric hydroxide, dextrin, starch, gelatin, egg-albumen, and silicic acid, and in presence of suspensions of silica and of charcoal, has been determined at 25° for the range of pressure from 250 mm. to 760 mm. of mercury. General confirmation of Findlay and Creighton's results (T., 1910, 97, 536) has been obtained, and it was also shown that the solubility of carbon dioxide in colloidal solutions is relatively high at low pressures, and that it diminishes with increasing pressure either to a constant value, or to a minimum value, after which the solubility increases again with rising pressure.

93. "Quinonoid addition as the mechanism of dyestuff formation."

By Arthur George Green.

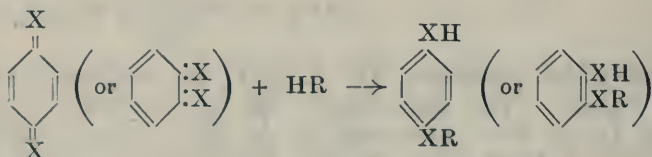
The following generalisation correlates a large number of well-known facts, and affords a ready explanation of the ease with which many very complex dyestuffs are produced.

1. All quinones and quinone-like compounds, by reason of their high degree of "unsaturation," exhibit a great attraction for hydrogen or equivalent groups, by the assumption of which they can pass into more saturated compounds.

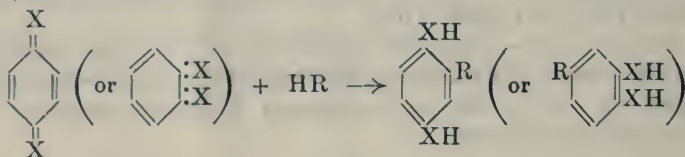
2. A very large proportion of dyestuff syntheses and the individual steps in such syntheses may be represented as consisting in the linking up of molecules brought about through the attractive forces of quinonoid groups.

3. Such reactions may occur in two ways, namely:

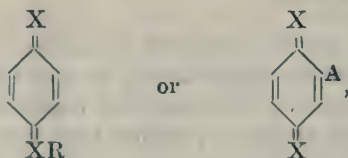
(a) *Direct Addition*:



(b) *Indirect Addition*:



4. In the presence of an oxidising agent, such as chromic acid, atmospheric oxygen, nitrobenzene, or another quinonoid compound, the above additive products may be again converted into quinonoid derivatives,



which under suitable conditions are ready to react again in the same way as before. Such alternate additions and reoxidisations may occur several times in succession, thus producing very complex molecular structures, such as those in the induline and aniline-black series.

94. "Sodium iodide with acetone of crystallisation."

By Kathleen Shipsey and Emil Alphonse Werner.

When anhydrous sodium iodide is dissolved in warm acetone, the solution on cooling, and after remaining for a short time, furnishes large, glassy, elongated prisms, which have the composition $\text{NaI}, 3\text{C}_3\text{H}_6\text{O}$. The crystals effloresce immediately after removal from the solution, and rapidly lose all the acetone on exposure to the air. A specimen of the crystals rapidly drained off from the mother liquor gave the following results:

Loss on exposure to dry air = 55.2. Found, I = 38.91.

$\text{NaI}, 3\text{C}_3\text{H}_6\text{O}$ requires $\text{C}_3\text{H}_6\text{O} = 53.7$; I = 39.19 per cent.

When ordinary acetone (b. p. 56—57°) is used, the crystals that are deposited have a brownish-pink colour, which is only partly due to free iodine, only a very faint colour being produced with a fresh starch solution.

From pure acetone the compound separates in colourless crystals, which assume a pale yellowish-brown colour after remaining in the liquid for twenty-four hours. The existence of this compound was noticed during the employment of a solution of sodium iodide in acetone for the preparation of certain iodo-derivatives.

Quite recently Marsh and Rhymes (P., 1913, **29**, 62) have described some double salts containing the iodides of potassium, ammonium, rubidium, and lithium with acetone of crystallisation, but curiously enough, no compound containing sodium iodide is referred to, whilst neither potassium nor ammonium iodides have yielded a compound under the same simple conditions as the sodium salt.

No compound was obtained when sodium iodide was dissolved in methyl ethyl ketone, acetylacetone, or ethyl acetoacetate.

A preliminary experiment has shown that when the compound $\text{NaI}, 3\text{C}_3\text{H}_6\text{O}$, prepared from commercial acetone, is heated on the water-bath, it gives a distillate of acetone which is devoid of any reducing action on a solution of potassium permanganate. The preparation of chemically pure acetone in a simple manner by the aid of this compound is being examined.

95. "Denitrification the result of enzyme action." (Preliminary note.) By William Hulme.

A fluorescent, denitrifying organism, from contact-bed slurry, was grown in nitrate-broth, and after several days the whole was filtered through a Chamberland filter into a sterilised bottle. This

filtrate, the sterility of which was checked by plate culture, was then tested for enzyme action as follows.

Three tubes, containing equal quantities of sterile nitrate-broth, were treated with equal quantities of the above filtrate (containing nitrite) and respectively (*a*) left untreated, (*b*) boiled, (*c*) treated with toluene. After remaining at 37° for some hours; the ratio of nitrite present was found to be $a : b : c = 2 : 1 : 2$.

The action of the "enzyme" free from nitrite was then investigated. Nitrate-broth was inoculated, and, after some days, was filtered through a Chamberland filter, as above. The filtrate was then precipitated with an excess of absolute alcohol and sodium chloride, the precipitate washed with absolute alcohol, and finally dissolved in distilled water. Equal quantities of this solution were added to 1 per cent. potassium nitrate solution; and the resulting nitrite production, after some hours, was as follows:

(<i>a</i>) 1 per cent. potassium nitrate solution alone	No nitrite
(<i>b</i>) Enzyme solution alone	No nitrite
(<i>c</i>) 1 per cent. potassium nitrate solution + enzyme solution	Very strong
(<i>d</i>) " " " " " (boiled)...	Strong

These results seem to show that denitrification is the result of enzyme action, and the whole question is now undergoing complete investigation.

96. "Allylamine derivatives: the identification of proline"

By Wilhelm Glud.

Some derivatives of allylamine have been studied as to their capacity of yielding pyrrole compounds. Oxalylmonoallylamine proved to be a good material for this purpose, readily furnishing oily products containing pyrrole compounds. It was prepared from ethyl oxalate and hydrolysis of the ester thus obtained, the interaction of oxalic acid and allylthiocarbimide not giving a sufficient yield of oxalylmonoallylamine.

Allylglycine was prepared from chloroacetamide and allylamine, and the allylamine hydrochloride removed with baryta and lead oxide. The copper salt was prepared in order to find out whether it can easily be distinguished from the corresponding salt of proline having the same empirical formula. It was found to be very similar to the copper salt of proline, but, unlike the latter, is anhydrous, so that the usual method of identifying the proline salt by estimation of water and copper is sufficient to distinguish it from the copper salt of allylglycine.

97. "Solubilities of salts of ammonium bases in water and in chloroform. Part I. Solubility as a constitutive property."
By Cyril James Peddle and William Ernest Stephen Turner.

With the object of testing whether any relationships exist between chemical composition and solubility, and between solubility and other physical properties, determinations have been made at the common temperature of 25° of the solubilities of twenty-four salts of ammonium bases in water, and of twenty-two of them in chloroform. The salts included chlorides, bromides, and iodides derived from amines related in such a way as to make a comparison possible, both of homologues and of isomeric substances; whilst the two solvents were of quite different types, the one an ionising, the other a neutral, medium.

It was shown that the substitution of organic radicles for hydrogen in an ammonium salt increases the solubility both in water and in chloroform, the increase being very great for alkyl radicles, but much smaller for aromatic. Chloroform was found an exceptionally good solvent for these salts.

On the whole, solubility in water decreases with increase in the mass of the substance; in chloroform, on the other hand, it increases. It was further shown that beyond a probable additive relationship between the solubilities in water of salts derived from the amines, the property is a highly characteristic one.

The effect of the relative molecular states of solvent and solute, as also of their respective dielectric constants, was also discussed.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Accum, Fredrick. Culinary chemistry, exhibiting the scientific principles of cookery, with concise instructions for preparing good and wholesome . . . alimentary substances employed in Domestic Economy, with observations on the chemical condition and nutritive qualities of different kinds of food. London 1821. ill. pp. xxiii + 356. (*Reference.*)

From Dr. Alexander Scott, F.R.S.

Chemical News, The. General Index to the Chemical News, Vols. 1 to 100. London 1913. pp. iv + 712. £2 net. (*Reference.*)

From Sir William Crookes, O.M., F.R.S.

Agricola, Georgius. De Re Metallica. Translated from the first Latin edition of 1556 with biographical introduction, annotations and

appendices upon the development of mining methods, metallurgical processes, geology, mineralogy & mining law from the earliest times to the 16th century. By *Herbert Clark Hoover* and *Low Henry Hoover*. London 1912. pp. [iv] + xxxi + 640. ill. (*Reference.*)

From Lewis T. Wright, Esq.

II. *By Purchase.*

Eisenlohr, Fritz. Spektrochemie organischer Verbindungen. Molekularrefraktion und -dispersion. Stuttgart 1912. pp. viii + 223. M.7.—. (*Recd.* 13/2/13.)

Euler, Hans. General chemistry of the enzymes. Translated by *Thomas Henry Pope*. New York 1912. pp. ix + 323. 12s. 6d. net. (*Recd.* 13/2/13.)

Knecht, Edmund, and Fothergill, James Best. The principles and practice of textile printing. London 1912. pp. xvi + 615. ill. £1 16s. 0d. net. (*Recd.* 13/2/13.)

At the next Ordinary Scientific Meeting on **Thursday, April 17th, 1913**, at **8.30 p.m.**, the following papers will be communicated:

"Action of tartaric acid on tin in the presence of oxygen." By *A. Chaston Chapman*.

"Reaction between ferric salts and thiocyanates." By *J. C. Philip* and *A. Bramley*.

"Preparation of pure bromine." By *A. Scott*.

"Preparation of conductivity water." By *R. Bourdillon*.

"Constitution of the anhydro-bases derived from tetrahydroberberine alkyl hydroxides." By *F. L. Pyman*.

"Application of Hofmann's reaction to dialkylacetamides." By *F. L. Pyman*.

"Derivatives of *o*-xylene." By *J. L. Simonsen*.

"Synthetical production of derivatives of dinaphthanthracene." By *W. H. Mills* and *M. Mills*.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29.

No. 414.

Thursday, April 17th, 1913, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the death on March 3rd of Mr. Frank Standish Findon, who was elected a Fellow on May 4th, 1905.

It was announced:

(1) That the van't Hoff Memorial Lecture will be delivered by Professor James Walker, F.R.S., on Thursday, May 22nd, 1913, at 8.30 p.m.

(2) That the Council has appointed the following Committees for the year 1913-14:

Finance Committee: Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William Tilden, and the Officers.

House Committee: Messrs. Horace T. Brown, W. R. Dunstan, R. Messel, J. E. Reynolds, J. M. Thomson, Sir Edward Thorpe, Sir William Tilden, and the Officers.

Library Committee: Messrs. B. Dyer, W. Gowland, A. Harden, J. T. Hewitt, C. A. Keane, A. R. Ling, T. M. Lowry, R. Meldola, E. J. Mills, J. M. Thomson (chairman), Sir William Tilden, J. A. Voelcker, the Editor, and the Officers.

Publication Committee: Messrs. H. B. Baker, J. N. Collie, F. G. Donnan, B. Dyer, M. O. Forster, T. M. Lowry, A. McKenzie, F. B. Power, and the Officers.

Research Fund Committee: Messrs. H. B. Baker, W. R. Bousfield, Horace T. Brown, J. N. Collie, H. B. Dixon, J. J. Dobbie, M. O. Forster, P. F. Frankland, A. Liversidge, W. J. Pope, and the Officers.

Messrs. R. B. Bourdillon, Thomas J. Kirkland, J. E. Barbary, E. K. Rideal, J. W. Smith, V. Steele, and C. E. Cooke were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

William Love Biggart, Rossarden, Kilmacolm, Renfrewshire.

Ghulam Ali Mahamadi, B.A., Elliehpur, Berar, India.

Ralph Richard Oliver, c/o Messrs. The Southern Fibre Co.,
Portsmouth, Va., U.S.A.

Ernest John Wilson, M.A., Osborne House, Wisbech.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Messrs.:

Hilton Ira Jones, Dakota Wesleyan University, Dakota, U.S.A.

Kali Prosonuo Rai, 147, Baranoshee Ghose Street, Calcutta.

Cornelius Williams, School of Agriculture, Cedara, Natal, South Africa.

Of the following papers, those marked * were read:

***98. "The action of tartaric acid on tin in the presence of oxygen."
By Alfred Chaston Chapman.**

When tin is partly immersed in a 5 per cent. aqueous solution of tartaric acid, no action occurs unless air is present. In these circumstances oxidation takes place at the surface of the liquid, and stannous tartrate is formed. If the action is allowed to proceed at the ordinary temperature, well-formed crystals slowly separate, the solutions in the case of the author's experiments having been allowed to remain undisturbed for three years. Contrary to existing statements, stannous tartrate readily undergoes dissociation even in the presence of tartaric acid, yielding under some conditions a colloidal solution. In the presence of a restricted supply of oxygen the stannous oxide undergoes slow oxidation, forming a brown-coloured, colloidal solution, which may contain as much as 6 per cent. of tin, and which, when heated with free exposure to the air, becomes converted into a bluish-white, colloidal liquid containing hydrated stannic oxide. The brown-

coloured solution evidently contains an oxide of tin intermediate between stannous and stannic oxides—probably the sesquioxide, the existence of which, on theoretical grounds, is very probable, and which has been referred to by several observers. That the oxide in question is not a molecular compound of stannous and stannic oxides is rendered probable by the fact that the brown colour is developed in solutions containing as much as 20 per cent. of sulphuric acid. Attempts to isolate the intermediate oxide and to prepare a tin alum have not been successful up to the present.

DISCUSSION.

Mr. F. P. WORLEY asked if the author had thought of employing other oxidising agents, such as hydrogen peroxide, in place of atmospheric oxygen. The latter obviously acted as depolariser, uniting with the hydrogen of the acid to form water, thus supplying sufficient energy to make the interaction exothermic.

Mr. CHAPMAN said that the conditions under which the coloured oxide was formed, and the fact that similarly coloured solutions could be obtained in the presence of 20 per cent. sulphuric acid, rendered it, in his opinion, exceedingly probable that the oxide was a definite oxide—probably the sesquioxide—and not a combination of two oxides. The precise causes leading to the formation of the colloidal condition were often very difficult to determine, and he had not been able to ascertain why the stannous hydroxide assumed a colloidal state in some cases and not in others. The crystals formed in these experiments consisted of pure stannous tartrate, and there was no evidence that the OH-groups had been attacked. The effect of hydrogen peroxide and permanganate had not been tried. Only two experimental bottles had been kept in the dark, and in neither case had there been any action on the tin, but this might quite well have been due to the fact that in these bottles the corks were air-tight.

*99. "The reaction between ferric salts and thiocyanates."

By James Charles Philip and Arthur Bramley.

It has been observed by various workers that the colour of the red solution obtained by mixing a ferric salt and a thiocyanate gradually diminishes in intensity. This is associated with the progressive reduction of the ferric iron to the ferrous condition, and the present investigation deals with (1) the products of the reaction, (2) the velocity of the reduction, as this is affected by altering the concentration, temperature, and other factors.

Corresponding with the reduction of the iron, there is an oxida-

tion of thiocyanic acid, the sulphur appearing as sulphuric acid, and the carbon as carbon dioxide, whilst the nitrogen of the oxidised acid is converted, partly at least, into ammonia.

The velocity of reduction of the ferric iron is quite appreciable at the ordinary temperature, and increases rapidly as the temperature rises. At a given temperature the change is very much slower when ferric salt is in excess than when thiocyanate is in excess. In the latter case addition of acid retards the reaction to a notable extent.

***100. "The preparation of pure bromine."**

By Alexander Scott.

The author recommends as the source of the purest bromine commercial potassium bromide, which has been boiled with small quantities of bromine water in order to eliminate any trace of iodine which may be present. The bromide, after recovery from the solution, should be fused with potassium dichromate in quantity somewhat less than that required for the liberation of all the bromine on treatment with sulphuric acid. The bromine thus obtained is free from chlorine, iodine, and all organic compounds.

The bromine of commerce may be completely freed from the other halogens by shaking it with small quantities of pure sodium hydroxide solution, when the chlorine is removed as chloride and the iodine as iodate.

It is easy to detect 1 part of iodine in 100,000 of bromine in this way by means of nitrosulphonic acid and chloroform, using only 10 cubic centimetres of bromine.

A simple form of apparatus, entirely of glass, was shown for the distillation of large quantities of bromine and similar substances without any inconvenience.

***101. "The preparation of conductivity water."**

By Robert Bourdillon.

Most of the methods hitherto described for preparing conductivity water produce water of a conductivity of 0.7 gemmho or more. A still has been made which gives seven or eight litres of water of a conductivity below 0.2 gemmho by a single distillation from tap water. The essential features are a large copper boiler, a spray trap consisting of a spiral coil of copper tubing, a condenser made of a vertical tin tube up which a current of purified air is passed, and the addition of a little potassium hydrogen sulphate to the water in the boiler. It is also found that by the use of an air-tight electrolytic cell, water of a conductivity of less than 0.2 gemmho

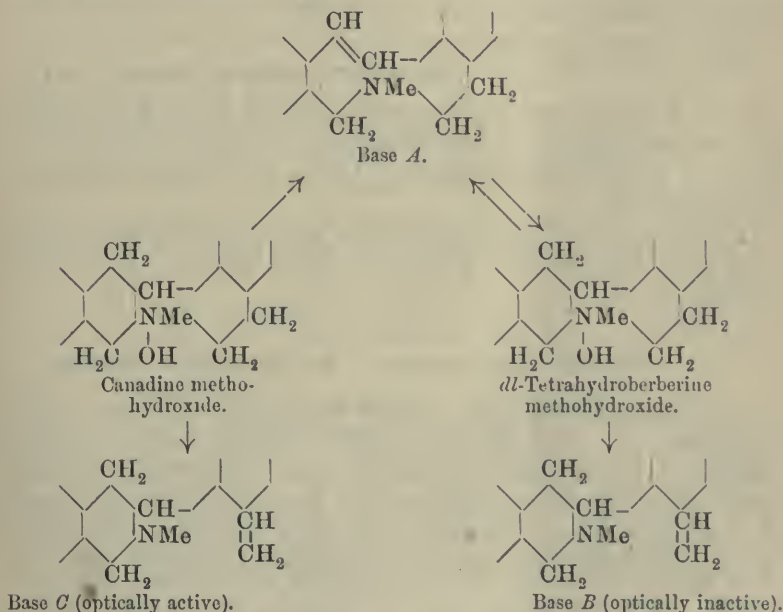
can be kept with only a very slow rise of conductivity, so that very dilute solutions can be studied accurately.

DISCUSSION.

Mr. BOURDILLON said, in reply to Prof. Baker, that the copper coil and trap described were loosely jacketed with cotton waste and boiler felt, but, in spite of this protection, about one-sixth of the steam from the boiler was condensed there.

***102. "The constitution of the anhydro-bases derived from tetrahydroberberine alkyl hydroxides." By Frank Lee Pyman.**

The formation of anhydro-bases by the dehydration of tetrahydroberberine and *l*-canadine (*l*-tetrahydroberberine) methohydroxides has been investigated. It was shown that in the former case two, and in the latter three, isomeric anhydro-bases are formed. As a result of the experimental data and theoretical considerations, it was concluded that the formation of the anhydro-bases may be explained by the following scheme:



The views of Voss and Gadamer (*Arch. Pharm.*, 1910, **248**, 43) and of McDavid, Perkin, and Robinson (*T.*, 1912, **101**, 1208) with regard to the constitution of the anhydro-bases derived from tetrahydroberberine alkyl hydroxides were discussed.

103. "The application of Hofmann's reaction to dialkylacetamides."

By Frank Lee Pyman.

It was shown that the dialkylacetamides—in particular dipropylacetamide—do not behave precisely similarly to the normal aliphatic acid amides (compare Hofmann, *Ber.*, 1882, **15**, 407, 752, 762; 1884, **17**, 1406, 1920) in respect of their behaviour to bromine and alkali.

Thus *diethyl-* and *dipropyl-acetobromoamides* are readily obtained in a crystalline form, whilst the bromoamides of the acids of the normal aliphatic series higher than propionic acid cannot be so isolated.

Dipropylacetobromoamide when treated with an excess of aqueous sodium hydroxide gives δ -aminoheptane in a yield amounting to 84 per cent. of the theoretical, whilst its isomeride, *n*-octoamide, under similar conditions yields only 30 per cent. of the theoretical quantity of *n*-heptylamine.

Normal aliphatic acid amides (2 mols.) when treated with bromine (1 mol.) and aqueous alkali hydroxides give acylalkylcarbamides in excellent yield:



but the dialkylacetamides, higher than *isobutyramide*, yield little or no acylalkylcarbamide, the corresponding dialkylcarbamide, for instance, *s-di- δ -heptylcarbamide* in the case of dipropylacetamide, being obtained.

The behaviour of dialkylacetamides thus resembles more closely that of phenylcarbimide than that of the normal aliphatic acid amides.

104. "Derivatives of *o*-xylene." By John Lionel Simonsen.

A full account was given of work which has already been briefly mentioned (*P.*, 1913, **29**, 26). The following substances were described: *3-nitro-o-xylenc-5-sulphonic acid*, *3-o-xyldine-5-sulphonic acid*, *3-nitro-o-xylene-4-sulphonic acid*, *3-o-xyldine-4-sulphonic acid*, *4-nitro-o-xylene-5-sulphonic acid*, *4-o-xyldine-5-sulphonic acid*, *3-o-xyldine-6-sulphonic acid*, and *4-o-xyldine-6-sulphonic acid*.

105. "Synthetical production of derivatives of dinaphthanthracene."

By William Hobson Mills and Mildred Mills.

In connexion with their recent communication on this subject (*T.*, 1912, **101**, 2194) the authors overlooked a paper by Dr. Ernst

Philippi, "Ueber eine Synthese von linearen Diphthaloylbenzol" (*Monatsh.*, 1911, **32**, 631), in which is described the preparation of dibenzoyl*isophthalic* acid, dibenzoyl*terephthalic* acid, and dinaphthanthradiquinone by the same methods as were employed by them. The authors greatly regret their oversight.

106. "The alcohols of the hydroaromatic and terpene series." (Preliminary note.) By Robert Howson Pickard, William Lewcock, and Joseph Yates.

The methods adopted for the isolation and purification of the borneols and *isoborneols* (T., 1907, **91**, 1973) and of the menthols (*ibid.*, 1912, **101**, 109) have been applied to fenchyl alcohol and *isopulegol*.

The reduction of *d*-fenchone by means of sodium in moist ethereal solution yields *l*-fenchyl alcohol, very little (if any) of the other possible isomeride being formed. This alcohol, by purification of the hydrogen phthalate, has now been obtained with a higher rotatory power than that stated in the literature. The successive fractionations of the magnesium and cinchonine (m. p. 174°) salts of this ester yield a *hydrogen phthalate* (m. p. 147° with $[\alpha]_D + 22.4^\circ$ in chloroform), which, when hydrolysed, gives *l*-fenchyl alcohol with $[\alpha]_D^{20} - 15.5^\circ$.

Tiemann (*Ber.*, 1896, **29**, 914) prepared *isopulegol* with $[\alpha]_D - 2.9^\circ$ from the condensation products of citronellaldehyde. His work has been repeated, and from these products one of the theoretically possible *isopulegols* has been isolated in a pure state. This has a specific rotatory power $[\alpha]_D^{20} - 22.2^\circ$, and forms a *hydrogen phthalate*, which melts at 106°, has $[\alpha]_D - 18.7^\circ$ in chloroform, and forms a *magnesium* salt, melting at 115° with $[\alpha]_D + 14.1^\circ$ in ethyl alcohol, and a *strychnine* salt, melting at 205° with $[\alpha]_D - 17.1$ in chloroform.

The application of these methods to the isolation in a pure state of the tertiary alcohols has been hindered by the difficulty of preparing their acid esters. The interaction at (say) 110° or above of equivalent amounts of such alcohols and acid anhydrides (phthalic, succinic, or camphoric) leads to the dehydration of the alcohols. It has, however, now been found that the long-continued action at temperatures below 100° of the anhydrides on an excess of the alcohols gives good yields of the desired acid esters. In this manner optically inactive terpeneol has been converted into its esters. The *hydrogen phthalate* melts at 117° and the *hydrogen succinate* at 45°, whilst both esters form crystalline salts with the commoner alkaloids.

107. "A new variety of manna and a note on the melting point of dulcitol." By John Ralph Furlong and Lawrence Eversley Campbell.

A specimen of leaves and twigs partly covered with a white incrustation ("manna") was received recently at the Imperial Institute from Mr. C. N. B. Venables, North Western Rhodesia. The plant was identified at the Royal Botanic Gardens, Kew, as a *Gymnosporia*, sp., probably *G. deflexa*, Sprague.

The incrustation had a slightly sweet taste, and was for the most part evenly deposited. It could be easily separated from the leaves and twigs, and contained 4.9 per cent. of moisture. On dissolving the manna in a small quantity of hot water and adding alcohol to the filtered solution, a crystalline substance separated in highly lustrous prisms melting at 183° (uncorr.) and 188° (corr.). This substance was optically inactive, even in the presence of borax, and did not reduce Fehling's solution either before or after heating with dilute acid. On oxidation with nitric acid it yielded mucic acid, and on acetylation gave a hexa-acetyl derivative melting at 171° (corr.). These results prove that the crystalline substance is dulcitol; it was isolated to the extent of 54 per cent. of the weight of manna used.

The residue of the manna after the removal of the dulcitol was a pale brown, sweet, gummy material, which reduced Fehling's solution, and gave indications of the presence of a furfuraldehyde-yielding complex. It contained 6.4 per cent. of reducing sugar, calculated as dextrose, and after heating with dilute acids yielded reducing sugar equivalent to 6.6 per cent. of sucrose, these two figures being expressed on the original manna. The residue could not be further examined owing to the small quantity available.

Some confusion appears to exist in the literature as to the melting point of dulcitol; for example, Beilstein, Abderhalden, Richter, and Watts in their handbooks give 188—189°, without stating that this is a corrected figure. Lippmann (*Ber.*, 1892, **25**, 3217) identified as dulcitol a substance which melted at 188° (uncorr.).

A sample of dulcitol (Kahlbaum) after repeated recrystallisation from alcohol, melted at 183° (uncorr.) and 188° (corr.).

108. "Blue adsorption compounds of iodine. Part II. The influence of constitution on the adsorption by 2- and 4-pyrone derivatives." By George Barger and Walter William Starling.

In a previous paper (Barger and Field, *T.*, 1912, **101**, 1394) the colloidal properties of the blue substances were described which are

formed by iodine with starch, cholalic acid, and saponarin. The phenomenon has since been found to be quite general, and occurs with some fifty of the substances which the authors have so far examined. In one case, that of naphthaflavone, the reaction is even more delicate than with starch, and a blue coloration is produced in solutions containing 1 part of iodine in 800,000 parts of water.

The power of adsorbing iodine seems to depend on the presence of a crossed conjugated linking, and on the residual affinity of oxygen (or sulphur). It is by no means confined to pyrone derivatives. It is greatly increased by benzene nuclei, as in the coumarins, chromones, xanthenes, and flavones; alkyl- and hydroxy-groups diminish it. Thus coumarin adsorbs slightly, hydrocoumarin and hydroxycoumarins not at all; naphthacoumarin, phenylcoumarins, and benzoyloxycoumarins are coloured blue by very dilute iodine solutions.

The authors have thus, for the first time, been able to examine the effect of the chemical constitution of the adsorbent, and their results agree closely with those already obtained by Freundlich and others in the study of the converse phenomenon, that is, the capacity of various organic substances of being adsorbed by the same adsorbent (charcoal).

The general conclusions of the first paper have been confirmed and extended. In no single case is the iodine taken up in stoicheiometrical proportions, although many of the blue substances can be obtained crystalline.

109. "Reactions of halogen-substituted acids. Part I. The action of sodium hydroxide and methoxide in methyl-alcoholic solution on bromoacetic, α -bromopropionic, and monobromosuccinic acids." By Erik Høst Madsen.

The effect of methyl-alcoholic solutions of sodium hydroxide and sodium methoxide on various bromine-substituted acids has been examined. Both reagents give rise to the methoxy-derivative in the case of bromoacetic and α -bromopropionic acids, whereas monobromosuccinic acid gives the corresponding methoxy-acid with sodium methoxide, but malic acid with sodium hydroxide, both reactions being accompanied by the formation of some fumaric acid.

In the case of the two first acids the velocity of reaction is the same for both sodium hydroxide and methoxide, but with bromosuccinic acid sodium hydroxide reacts with the greater velocity. The order of reaction is different with the three acids; α -bromopropionic acid gives a reaction of the first order, bromoacetic acid

one of the second order, and bromosuccinic acid one of a higher order, which was not determined.

110. "The preparation and analysis of methane."

By Colin Campbell and Albert Parker.

Methane was prepared by the action of hot water on pure aluminium carbide. Acetylene was removed by means of an ammoniacal solution of cuprous chloride. The gas was freed from hydrogen by first adding a slight excess of oxygen and then passing the mixture over palladium black at 90° to 100° . Analysis showed the methane to be practically pure. A method of analysis was devised, by which 0.05 per cent of hydrogen could be estimated.

111. "Influence of increase of initial temperature on the explosiveness of gaseous mixtures." By Albert Parker.

Mixtures of methane, carbon monoxide, hydrogen, and coal gas were made with oxygen and with air, and sparked in a eudiometer tube at the ordinary temperature and at 100° under various pressures. It was found that increase of initial temperature decreased the values of the lower limits of explosibility of the above gases. It was also found that the values of the lower limits of explosibility of methane, carbon monoxide, and coal-gas were higher for mixtures with oxygen than for mixtures with air.

112. "Keto-enolic tautomerism and the absorption spectra of the aliphatic ketones." By Harry Medforth Dawson.

From an examination of the data expressing the rate at which the aliphatic ketones react with sodium hydrogen sulphite and hydroxylamine, it was shown that these reactions have no connexion with the intramolecular change of linking associated with the keto-enolic transformation. These data cannot therefore be cited in support of the view that selective absorption in the ultra-violet is connected with the intramolecular change of linking involved in the transfer of a labile hydrogen atom (compare Baly and Desch, T., 1904, 85, 1029; 1905, 87, 766; Stewart and Baly, *ibid.*, 1906, 89, 489).

The interpretation of absorption spectra and of extinction curves was discussed, and it was shown that the so-called persistence of a selective absorption band is of no particular value. In order to obtain comparative numbers representing the selective absorption capacities of the individual members of a group of similar sub-

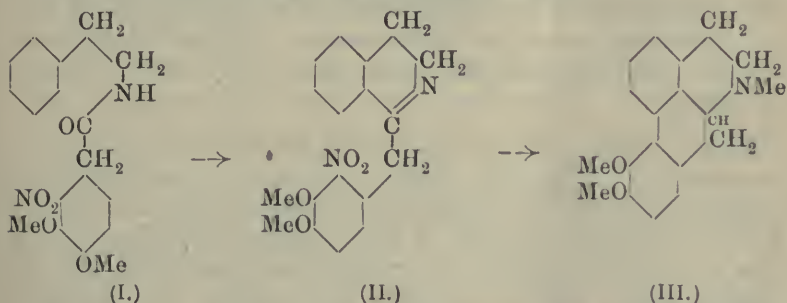
stances, measurements are required which will afford a means of ascertaining the relative thicknesses of layers of equimolar solutions which give rise to the same amount of selective absorption.

The absorption-coefficients of the aliphatic ketones for light of the frequency supposed to be characteristic of the $\cdot\text{CH}_2\cdot\text{CO}\cdot$ group were shown to have no connexion with the corresponding rates of isomeric change. Furthermore, in the case of acetone it is found that when the rate of isomeric change is increased to something of the order of 100,000 times, there is practically no alteration in the absorption of the characteristic ultra-violet radiation. These facts indicate that the behaviour of the simplest keto-enolic tautomerides is absolutely incompatible with the Baly-Desch theory.

113. "Experiments on the synthesis of *apomorphine*."

By Francis William Kay and Amé Pictet.

With the object of synthesising *apomorphine*, the authors have attempted the preparation of 2-nitroveratryldihydroisoquinoline (II), by means of reactions already described by them (*Ber.*, 1909, **42**, 1973). On submitting such a derivative of *isoquinoline* to a treatment similar to that described by Pschorr (*Ber.*, 1904, **42**, 1926) and by Gadamer (*Arch. Pharm.*, 1911, **680**, 249) for the conversion of nitropapaverine into *dl*-glaucine, it would be expected to yield the dimethyl ether of *apomorphine* (III):



Although 2-nitrohomoveratryl- β -phenylethylamine (I) does actually lose water when heated with phosphoric oxide in solution in boiling toluene, yet it fails to yield a derivative of *isoquinoline* by ring-formation as would be expected, a yellow, indifferent substance, m. p. 129° , being obtained instead. This dehydro-product is still a derivative of phenylethylamine, for when reduced with tin and hydrochloric acid it yields that base.

o-Nitrophenylacetyl- β -phenylethylamine, colourless crystals, m. p. 97 – 99° , fails to lose water when submitted to the action of phosphoric oxide in boiling xylene.

114. "The absorption spectra of various derivatives of benzene."

By John Edward Purvis and Nial Patrick McClelland.

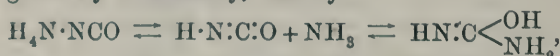
The absorption spectra of the vapours, solutions, and thin films of some of the simpler benzene derivatives have been compared, and particularly various nitro-compounds. The results were discussed from a consideration of the oscillations of different electronic centres.

115. "Notes on the determination of the electrical conductivity of solutions." By Harold Hartley and William Henry Barrett.

The electrical resistance of aqueous solutions of potassium chloride has been measured by a telephone and induction coil, and also by the rotating commutator and galvanometer, and it has been found that the two methods yield different values for the resistance. The values found by the telephone are about half a per cent. lower than those found by the second method. A new form of conductivity cell has been devised for use with dilute solutions of aqueous and non-aqueous solutions in which the solvent is protected from contact with atmospheric impurities.

116. "Mechanism of the transformation of ammonium cyanate into carbamide, and of the decomposition of carbamide by heat. The polymerisation of cyanic acid." By Emil Alphonse Werner.

It was pointed out that the theory recently put forward by Chattaway (T., 1912, 101, 170) to explain the transformation of ammonium cyanate into carbamide, and the formation of biuret and cyanuric acid from the latter is open to serious objection, since it fails to account for several of the phenomena connected with the changes, and is not in agreement with others. The reversible reactions given by Chattaway, namely:



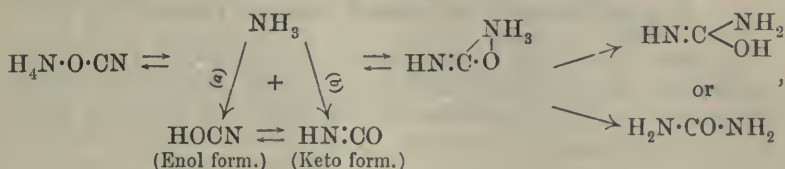
is difficult to conceive, cyanic acid being supposed to have the fixed constitution $\text{H}\cdot\text{N}:\text{C}:\text{O}\cdot$.

The whole series of changes, it was shown, can be easily explained and understood by taking into consideration the two fundamental causes, namely, dissociation and the reversible change,



and no hypothetical intermediate compounds are required to help

the explanation. Thus, the following scheme explains the formation of carbamide:



the lower temperature being favourable to reaction (a), the higher to reaction (b), whilst biuret results from the interaction of carbamide and cyanic acid, as has been proved by direct experiment. A theoretical explanation of the formation of cyanuric acid and cyamelide respectively from cyanic acid was given, based on the existence in equilibrium of the two forms of the acid. The sublimates formed when carbamide and biuret are decomposed by heat were shown to consist of ammonium cyanate and carbamide in variable proportions according to the experimental conditions, and the general impression that carbon dioxide is a product of the decomposition of carbamide by heat was shown to be unfounded; the vapours evolved consist solely of ammonia and cyanic acid.

117. "Non-aromatic diazonium salts. Part I. Antipyrinediazonium salts and their azo-derivatives." By Gilbert T. Morgan and Joseph Reilly.

1-Phenyl-2: 3-dimethylpyrazolone-4-diazonium chloride and the other diazonium salts previously described (P., 1912, **28**, 334) coupled readily with aromatic amines and the aliphatic β -diketo-compounds.

1-Phenyl-2:3-dimethylpyrazolone-4-azo- β -naphthylamine (m. p. 234—235°), unlike the purely aromatic azo- β -naphthylamines, yielded intensely dark purple salts, stable in aqueous solution.

1-Phenyl-2:3-dimethylpyrazolone-4-azoacetylacetone (m. p. 181—182°) gave rise to an orange, sparingly soluble, sodium derivative, developing the enolic red coloration with ferric chloride, and yielding an olive-green copper derivative.

Ethyl 1-phenyl-2:3-dimethylpyrazolone-4-azoacetate (m. p. 174—175°) resembled the foregoing compound.

The coupling of antipyrinediazonium salts and methyl acetyethyl ketone (acetylmethylacetone) was accompanied by the elimination of an acetyl group, so that the resulting condensation product, m. p. 199—200°, is derived from methyl ethyl ketone or dimethyl diketone (diacetyl), according as to whether it is to be regarded as an azo-derivative or a hydrazone.

118. "The fractionation of alloys and minerals in the electric micro-furnace." By **Arnold Lockhart Fletcher**.

An instrument—the micro-furnace—was described for a rapid qualitative and quantitative analysis of small quantities of alloys. The method described amplifies the classification of the more refractory alloys (Turner, T., 1912, **101**, 585).

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Alchemical Society. The Journal of the Alchemical Society. Vol. I, parts 1 to 3. Edited by *H. Stanley Redgrove*. London 1913. (*Reference.*) From the Editor.

Bluntschli, F., Lasius, G., and Lunge, Georg. Die chemischen Laboratorien des Eidgenössischen Polytechnikums in Zürich. Zurich 1889. pp. 39. ill. (*Recd.* 7/4/13.) From T. H. Russell, Esq.

Dodgson, John Wallis, and Murray J. Alan. A foundation course in chemistry for students of agriculture and technology. London 1913. pp. x + 244. ill. 3s. 6d. net. (*Recd.* 15/3/12.)

From the Publishers: Messrs. Longmans, Green and Co.

Durham College of Science, Newcastle-upon-Tyne. [A Description of the Buildings. Newcastle-upon-Tyne 1888.] pp. 16. ill. (*Recd.* 7/4/13.) From T. H. Russell, Esq.

Findlay, Alexander. Osmotic Pressure. London 1913. pp. iv + 84. 2s. 6d. net. (*Recd.* 16/5/13.) From the Author.

Franzen, Hartwig. Exercises in gas analysis. Translated by *Thomas Callan*. London 1913. pp. vii + 120. 2s. 6d. net. (*Recd.* 12/3/13.) From the Publishers: Messrs. Blackie and Son.

Liversidge, Archibald. The proposed Chemical Laboratory at the University of Sydney. Sydney 1888. pp. 4. ill. (*Recd.* 7/4/13.)

From T. H. Russell, Esq.

Roscoe, Sir Henry Enfield. Description of the Chemical Laboratories at the Owens College, Manchester. 3rd edition. Manchester 18 1. pp. 4. ill. (*Recd.* 7/4/13.) From T. H. Russell, Esq.

II. *By Purchase.*

Allen, Alfred H. Commercial organic analysis. Vol. VII. 4th edition. Edited by *William Alfred Davis* and *Samuel S. Sadtler*. London 1913. pp. ix + 563. ill. 21s. 0d. net. (*Reference.*)

Hatschek, Emil. An introduction to the physics and chemistry of colloids. London 1913. pp. ix+94. ill. 2s. 6d. net. (*Recd.* 14/4/13.)

Henrich, Ferdinand. Theorien der organischen Chemie. Second edition of "Neuere theoretische Anschauungen auf dem Gebiete der organischen Chemie. Braunschweig 1912. pp. xiv+401. M.11.—. (*Recd.* 15/4/13.)

Henry, Thomas Anderson. The plant alkaloids. London 1913. pp. vii+466. 18s. 0d. net. (*Recd.* 10/4/13.)

Korczyński, Anton Ritter von. Die Methoden der Exakten, quantitativen Bestimmung der Alkaloide. Berlin 1913. pp. iv+82. M. 3.50. (*Recd.* 10/4/13.)

Marggraf, Andreas Sigismund. Einige neue Methoden, den Phosphor im festen Zustande sowohl leichter als bisher aus dem Urin darzustellen als auch denselben bequem und rein aus brennbarer Materie (Phlogiston) und einem eigentümlichen, aus dem Urin abzuscheidenden Salze zu gewinnen. Translated from the Latin and French by **Georg Johannes Mielke.** (*Ostwald's Klassiker*, No. 187). Leipzig 1913. pp. 54. M. 2.25. (*Recd.* 12/2/13.)

Roux, Ulysse. La grande industrie des acides organiques. Bitartrate de potasse ou crème de tartre. Acid tartrique. Acide citrique. Paris 1912. pp. viii+544. ill. 20 fr. (*Recd.* 13/2/13.)

Soddy, Frederick. The chemistry of the radio-elements. London 1911. pp. iv+92. 2s. 6d. net. (*Recd.* 14/4/13.)

Wren, Henry. Organometallic compounds of zinc and magnesium. London 1913. pp. viii+100. 1s. 6d. net. (*Recd.* 14/4/13.)

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 2nd, 1913.

All persons who received grants in June, 1912, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Monday, June 2nd, 1913.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore,

that the income due to the sum accruing from the Perkin Memorial Fund is applied to investigations relating to problems connected with the coal-tar and allied industries.

VAN'T HOFF MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, May 22nd, 1913, at 8.30 p.m., when the van't Hoff Memorial Lecture will be delivered by Professor James Walker, F.R.S.

At the next Ordinary Scientific Meeting on Thursday, May 1st, 1913, at 8.30 p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Dinaphthathioxin and isodinaphthathioxin." By T. J. Nolan and S. Smiles.

"Bismuthinitrites." By W. C. Ball and H. H. Abram.

"Constitution of aliphatic diazo-compounds." By M. O. Forster and D. Cardwell.

"The estimation of zinc as zinc ammonium phosphate and zinc pyrophosphate." By T. M. Findlay and A. C. Cumming.

"Condensation of acetonedicarboxylic acid with phenols." By B. B. Dey.

"Oxidation of sphingosin." By A. Lapworth.

"Conversion of sodium hydrosulphide into sodium monosulphide." By J. S. Thomas and A. Rule.

"Influence of temperature and pressure on the rate of volatilisation of zinc and of cadmium." By T. K. Nair and T. Turner.

"Constitution of oxadiazole oxides (furazan oxides or dioxime peroxides)." By A. G. Green and F. M. Rowe.

"Constitution of furoxans (dioxime 'peroxides')." By M. O. Forster and M. F. Barker.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 15th, 1913.

Batey, John Percy,

3, Minorca Road, Weybridge, Surrey.

Chemist. At present assistant to Dr. Ad. Liebmman, Weybridge. M.Sc.Tech.; Schuster Research Scholar, 1908, at the School of Technology, Manchester. Publications (alone): “Notes on the Formation of Hypiodites, etc.,” *The Analyst*, April, 1911; with Prof. Knecht: “On the Condition of some Dyestuffs in Aqueous Solution,” *J.S.D.C.*, p. 194, 1909: “On the Condition of Indigo White in Aqueous Solution,” *J.S.D.C.*, January, 1910, July, 1910; “A Modification of the Beckmann Apparatus,” *J.C.S.*, 101, p. 1189 (1912).

Ad. Liebmman.

Otto Hehner.

James Dewar.

J. Lewkowitsch.

Edmund Knecht.

T. P. Hilditch.

Battye, Horace George,

28, Roman Place, Roundhay, Leeds.

Chemist and Works Manager. Chemist and Works Manager for B. R. Vickers & Sons, Oil, Soap and Chemical Manufacturers, Leeds, for 4 years; late assistant to Dr. L. Gordon Paul, F.I.C., Huddersfield, nearly 3 years; studied Chemistry, etc., under J. Hembrough, A.I.C., A.R.C.Sc., etc., 6 years.

L. Gordon Paul.

J. Hembrough.

F. W. Branson.

Arnold R. Tankard.

Harry Thompson.

Blackburn, George Frederick William,

25, Rowington Road, Norwich.

Schoolmaster with 15 years' experience in teaching; holding certificates

in Science of Board of Education. Desirous of keeping in touch with the latest researches in Chemistry to aid private work.

Sydney Hall.

Harold Rogerson.

Martin Remers.

M. P. Applebey.

R. W. Merriman.

Cahen, Edward, A.R.C.Sc., F.I.C.,

32, Queen's Road, Bayswater, W.

Chemist; Demonstrator at St. Bartholomew's Hospital. Author of numerous contributions to current chemical literature; joint author of "The Mineralogy of the Rarer Metals"; late member of the junior staff at the Imperial College of Science and Technology, South Kensington; Assistant to Mr. Harbord, F.I.C., Jan. 1912; Demonstrator at St. Bartholomew's Hospital and College.

William A. Tilden.

P. W. Robertson.

M. O. Forster.

W. H. Hurtley.

Chapman Jones.

J. C. Withers.

H. F. Harwood.

A. T. King.

James C. Philip.

F. P. Dunn.

Caruth, Alexander,

101, Singleton Avenue, Prenton, Birkenhead.

Mathematical Master at the Hr. E. School, Birkenhead, and Lecturer at the Holt School of Science. A.R.C.Sc. (London) in Chemistry; late Lecturer in Chemistry at the Birkenhead P.T. Centre; 1st Class Honours Certificate in Chemistry, Board of Education (1909).

M. O. Forster.

Chapman Jones.

James C. Philip.

J. C. Withers.

F. P. Dunn.

H. F. Harwood.

Coppin, Noël Guilbert Stevenson,

"Rydal Mount," Runcorn, Cheshire.

Research Chemist in the Castner-Kellner Alkali Works, Runcorn, and Lecturer in Chemistry in the Runcorn Technical Institute. B.Sc. (Liv.), 1910; M.Sc.(Liv.), 1912; two years' research experience in the Organic Laboratory of the University of Liverpool, under Dr. A. W. Titherley; worked on the "Constituents of Comfrey Rhizome" (*Pharm. Journ.*, 1912, [iv], 34, 92); also on the condensation of chloral and urea, the mechanism of the oxidation of uric acid, and the constitution of allanturic acid.

A. W. Titherley.

F. G. Donnan.

E. C. C. Baly.

R. E. Slade.

G. D. Bengough.

Cox, Arthur Hawker,

4, St. Peter's Place, Brighton.

Managing Director. Manufacturing Chemist.

J. H. B. Wigginton.

George A. Goddon.

Edwin Harrison.

G. Mason Williams.

Herbert E. Burgess.

Crutchley, Arthur Ernest,

230, Albert Road, Handsworth, Birmingham.

Chief Chemist to the County Chemical Co., Ltd., Birmingham. Held the above position for the past four years, and in that capacity have had a varied experience in General Analytical work, especially with regard to Rubber and Oils. Have brought out and perfected most of the well-known "Chemico" specialities for the Cycle and Motor trade, with the assistance and advice of my Managing Director, Mr. Wilfred Hill.

Herbert Stephen Shorthouse.

C. H. Ridsdale.

Henry James Aubrey.

Philip Schidrowitz.

Thomas Tyrer.

Dalal, Vasanji Premji, M.A., B.Sc.,

"Gnana Geha," Central Hindu College, Benares.

Hon. Professor of Chemistry, Central Hindu College, Benares. Hon. Professor of Chemistry, Central Hindu College; formerly for five years Lecturer in Chemistry, Elphinstone College. Proprietor and Chemist of the Lotus Soap Factory, Bombay.

E. M. Modi.

M. J. Gajjar.

A. R. Normand.

Kapibram H. Vakil.

A. N. Peston Jumas.

Davies, Harold,

18, Windsor Road, Ilford, Essex.

Research Chemist. A.I.C. Publications: Kipping and Davies, "Organic Derivatives of Silicon. Part IX," *Trans.*, 1909, Vol. 95; "Different Methods of Applying the Grignard Reagents," *Trans.*, 1911, Vol., 99; Weizmann, Davies and Stephen, "Condensation of Acid Chlorides with (a) Cyanoacetic, (b) Malonic and (c) Acetoacetic Esters," *Proc. Chem. Soc.*, 1912, Vol. 28. At present engaged in Technical Research.

F. E. Matthews.

H. B. Dixon.

H. J. W. Bliss.

Ch. Weizmann.

W. H. Perkin.

E. C. Edgar.

Dix, Alfred Gilbert,

110, Tufnell Park Road, Holloway, N.

Teacher. B.Sc. with 2nd. Class Honours in Chemistry (London

Univ.) ; six years a Student at Northern Polytechnic Institute, Chemical Department ; teacher of Science at Mansfield Road Senior School.

W. H. Mills.

Wm. T. Boone.

C. R. Wilkins.

F. P. Dunn.

J. C. Withers.

Haber, Fritz,

Berlin-Dahlem, Post Lichterfelde 3, Germany.

Professor in the Kaiser Wilhelm-Institut für physikalische Chemie und Elektrochemie. Well known as one of the most-brilliant researchers in the province of Physical Chemistry.

William Ramsay.

R. Whytlaw-Gray.

J. Norman Collie.

Irvine Masson.

Samuel Smiles.

Hill, Percy Wolmer,

43, Holyhead Road, Wednesbury.

Chief Chemist, Messrs. The Patent Shaft and Axletree Co., Ltd., Wednesbury. Have passed the Honours Examinations in Practical and Theoretical Metallurgy at Wednesbury ; Teacher : Mr. Walter Macfarlane, F.I.C. Object : to keep in touch with the latest Chemical information and research.

J. A. Hatfield.

S. Lamb.

J. H. Lavender.

H. Essex.

R. Lloyd Whiteley.

Hodsoll, Harold Edward Pollock,

22, Pembroke Mansions, London, W.

Chemical Manufacturer. Senior Scholar and Honours Diplomatist of Wye College ; for three years Lecturer at Colonial College ; subsequently Inspector of Agriculture to Sudan Government ; now Managing Director of Reuny Forbes & Co., Ltd., Manufacturing Agricultural Chemists, where engaged—among other things—in ascertaining the value of soil analysis for commercial purposes by analysing soils from various parts of the country and noting results of different manurial treatments ; also working on special treatment of various organic materials to render them more available as plant food ; lecturing frequently before Growers' Associations and Farmers' Clubs, etc.

S. J. M. Auld.

M. J. R. Dunstan.

A. D. Hall.

E. J. Russell.

Wm. Goodwin.

Holroyd, Thomas Arthur, B.Sc.,

Carnbuck Club, Perambur Barracks, Madras, India.

Colour Chemist, engaged in the Dye Works of Messrs. Binney & Co., Madras. I spent 4 years at Leeds University; two years I spent in General Chemistry; third and fourth years specialised in Colour Chemistry; in my third year I took the final exam. in Chemistry for my B.Sc. degree; fourth year I spent in the Clothworkers research laboratory and obtained a first class honours B.Sc. in Colour Chemistry.

A. G. Green.

Arthur Smithells.

A. G. Perkin.

J. B. Cohen.

Henry R. Procter.

Hutchinson, Percy,

74, Hotham Road, Putney, London, S.W.

Teacher of Science. B.Sc. (London); Teacher's Diploma, University of London, King's College; educated, Manchester University and King's College; four years' experience in Public Analytical and Industrial Chemistry with T. J. Hutchinson, F.I.C., Public Analyst for Bury, Lancs. At present teaching in University of London, King's College for Women.

Harold B. Dixon.

Herbert Jackson.

W. H. Perkin.

H. L. Smith.

Patrick H. Kirkaldy.

Kanga, Darab Dinsha,

Bombay.

Master of Arts (Chemistry) (First Class), Bombay University. Lecturer in Chemistry, Elphinstone College, Bombay; Government of Bombay Scholar; Research Student, Indian Institute of Science, Bangalore; investigations in Lantana Camara and Lavandhla Burmanni; Author of a brochure, "Chemistry and Industry"; Examiner in Elementary Science, Bombay University.

J. J. Sudborough.

H. E. Watson.

Morris W. Travers.

F. L. Usher.

N. S. Rudolf.

Paul Brühl.

Keller, Douglas Rayment,

48, Weymouth Street, Watford.

Assistant Chemist in Mr. R. H. H. Stanger's laboratories, Westminster, S.W. B.Sc. (London) with Honours in Chemistry; Diploma of the Central Technical College (A.C.G.I.) in the department of Chemistry; awarded Honours Certificate by the City and Guilds of

London Institute for research ("Studies in Solutions," part of No. XI, *Proc. Roy. Soc.*, 1910, A, 84, p. 123).

Henry E. Armstrong.

Edward Horton.

W. Robertson.

R. T. Colgate.

J. Vargas Eyre.

R. H. Harry Stanger.

W. A. Davis.

S. Dickson.

Kur, Emmanuel Francis,

Learansa, Devonshire Road, St. Annes-on-Sea.

Technical Chemist and Colourist. Introduced the Bisulphites of Cr and Al to the Printing Trade (Calico) in 1889; also xanthogenic starch as solvent for sulphide dyes, 1910. Connected with the Aniline Dye Trade since 1881.

Jul. Hübner.

C. Rawson.

Edmund Knecht.

Raymond Ross.

W. H. Pennington.

Gilbert J. Fowler.

Lawson, Joseph Stuart,

18, Old Swan Lane, E.C.

Analytical Chemist. Assistant to Carter White, F.C.S., A.I.M.E., 18, Old Swan Lane, E.C., and Chemist to The White Chemical Syndicate, Ltd., Battersea, S.W.

Carter White.

John William Patterson.

Harold Rogerson.

G. Mason Williams.

L. Myddelton Nash.

Lloyd, Harold Charles,

Ferndale, Trinity Square, Llandudno.

Science Master, Central School, Llandudno; Lecturer, Chemistry and Physics, Central School Evening Classes. B.Sc. University of Birmingham. Junior Science Master, Bridgnorth Grammar School, 1910-12. Desirous to keep in touch with latest investigations in Chemistry and to have access to the Society's publications.

Percy F. Frankland.

Frank H. Wall.

Hamilton McCombie.

Ernest Vanstone.

C. K. Tinkler.

Frederick Challenger.

Edward P. Frankland.

McCann, John Francis,

2, Prince of Wales Terrace, Sandymount Av., Ballsbridge, Co. Dublin.

Chemist at the Dublin Corporation Sewage Works, and Student of

the College of Science, Dublin. Licentiate and Member of the Pharmaceutical Society of Ireland.

Jos. Reilly.

James H. Pollok.

G. T. Morgan.

A. O'Farrelly.

H. I. Gorman.

Maynard, Harry Bertram,

The Park, Kingswood, Bristol, and c/o Leo Taylor, F.I.C.,
31, Moorgate Street, E.C.

Analyst and Assayer. Chief Assistant to Leo Taylor, Public
Analyst for Hackney.

Percy Edgerton.

B. C. Smith.

W. M. Seaber.

M. S. Salamon.

Arth. J. Starey.

Mehta, Bhaichand Anupchand,

Rajkote (Kathiawad).

Research Student in the Indian Institute of Science, Bangalore.
M.A. in Chemistry of the Bombay University. Scientific Study of
Oils and Fats.

M. W. Travers.

Paul Brühl.

J. J. Sudborough.

A. K. Yegna Narayan Aiyer.

H. E. Watson.

H. V. Krishnayya.

Miller, Arthur George Abraham,

1, Pretoria Terrace, Waltham Cross, Herts.

Analytical Chemist in the Royal Small Arms Factory at Enfield
Lock; hold the London Bachelor of Science Degree, with Honours in
Chemistry; engaged in Analytical Work as a daily occupation;
Lecturer in Chemistry in the George Williams College, London Central
Y.M.C.A.

J. T. Hewitt.

Frank G. Pope.

Clarence Smith.

A. D. Mitchell.

Arthur E. Pitt.

Potter, Francis Martin,

6, Stavordale Road, Highbury, N.

Technical Research Chemist. Associate Royal College of Science;
B.Sc. (Hons. Chem., London); A.I.C.

H. Brereton Baker.

Chapman Jones.

James C. Philip.

H. F. Harwood.

M. O. Forster.

J. C. Withers.

William A. Tilden.

Robinson, Arthur Samuel.

King's School, Pontefract.

Schoolmaster. Graduate of Manchester University; B.Sc., 1st Class Honours in Chemistry; late Graduate Scholar of Manchester University; Science Master, King's School, Pontefract; Lecturer in Chemistry, Pontefract Technical School.

Harold B. Dixon.

A. Lapworth.

W. H. Perkin.

Ch. Weizmann.

E. C. Edgar.

Ruffley, John Robert,

130, Worsley Road, Farnworth R.S.O., Bolton.

Chief Assistant to the Borough Analyst, County Borough of Bolton. Engaged as Assistant as stated above. Engaged in analytical and technical chemical work; to which I intend to devote my time; have been so engaged several years.

Stanley J. Peachey.

Edmund Knecht.

F. S. Sinnatt.

Walter Ratcliffe.

Jno. L. Whiteside.

Rusby, Reginald William,

Westgate, Greenhill Road, Moseley, Birmingham.

Aniline Colour Manufacturer's technical representative. Student, Yorkshire College, Leeds, 3 years. Technical representative of Aniline Colour Manufacturer for 23 years.

Arthur Smithells.

Edmund Knecht.

Walter M. Gardner.

Stanley J. Peachey.

Jul. Hübner.

W. H. Pennington.

William Duncan.

Raymond Ross.

Sahiar, Hormusji Kharshedji,

Indian Institute of Science, Bangalore, India.

Demonstrator and Research Student, Department of Organic Chemistry, Indian Institute of Science. M.A. (First Class in Chemistry, Bombay). Springer Research Scholar (1909-10 and 1911, University of Bombay). "Determination of the Constituents in Swertia Chiretta," work carried on at the Indian Inst. of Science.

J. J. Sudborough.

N. S. Rudolf.

M. W. Travers.

H. E. Watson.

F. L. Usher.

Sastry, Sosale Garalapury, B.A.,

Kavithavilas, Mysore, India.

Research Student, Dept. of Organic Chemistry, Indian Institute

of Science, Hebbal, Bangalore. Bachelor of Arts (Madras University).

J. J. Sudborough.

N. S. Rudolf.

Morris W. Travers.

H. V. Krishnayya.

H. Edmeston Watson.

A. K. Yegna Narayan Aiyer.

Francis L. Usher.

Shrewsbury, Herbert Sutcliffe,

Government Laboratory, Trinidad, B.W.I.

Principal Assistant Government Analyst, Trinidad and Tobago. F.I.C. Ten papers in the *Analyst* (1907-1913); mainly original analytical methods. Two papers in the *Bulletin* of the Dept. of Agriculture of Trinidad (1911 and 1912).

F. Stanley Kipping.

Harry Silvester.

R. M. Caven.

A. Chaston Chapman.

Arnold R. Tankard.

Stansfield, William James,

12, Bell Hall Terrace, Savile Park, Halifax.

Teacher. Associate of the Royal College of Science, London, in Chemistry. For six years Lecturer in Chemistry at the Municipal Technical College, Halifax.

G. T. Morgan.

C. A. Crook.

E. W. Smith.

Wm. Cranfield.

J. H. Dyson.

Wigginton, Panks James,

54, Grand Parade, Brighton.

Manager. Manufacturing Chemist.

J. H. B. Wigginton.

George A. Goddon.

Edwin Harrison.

G. Mason Williams.

Herbert E. Burgess.

Winstanley, Thomas Harrison,

45, Dicconson St. West, Wigan.

Chemist. Member of the Pharmaceutical Society. I have a keen desire to keep up with the latest investigations in Chemistry.

T. H. Byrom.

John Rennie.

R. O. Burland.

S. Ernest Melling.

G. Crewe Chambres.

G. T. W. Newsholme.

C. G. Moor.

Wyver, Clifton,

37, Boveton St., Wolstanton, Stoke-on-Trent.

Chief Chemist and Assistant Engineer, Burslem Gas Works, Stoke.

on-Trent. Six years Pupil and Assistant to my father, Mr. W. Wyver, Engineer and Manager, Whitstable Gas and Waterworks Co.; 2 years Deputy Chemist, Burslem Gas Works; $3\frac{1}{2}$ years Chief Chemist and Assistant Engineer, Burslem Gas Works. Honours in Gas Engineering (City and Guilds of London). Am desirous of keeping in touch with the development of Chemistry.

C. V. Hodgson.

Edward Jackson.

Thos. Allcock.

T. E. Pye.

F. Napier Sutton.

Young, William John, M.Sc.(Manchester), D.Sc.(London),
Australian Institute of Tropical Medicine, Townsville, N.
Queensland, Australia.

Head of Biochemical Department, Australian Institute of Tropical Medicine. Engaged in Biochemical research. Author or joint author of numerous papers on subjects connected with Alcoholic Fermentation.

Arthur Harden.

Roland V. Norris.

Charles A. Keane.

E. Ashley Cooper.

R. H. A. Plimmer.

The following Certificates have been authorised by the Council for presentation to Ballot, under Bye-law I (3):

Garland, Herbert,

Helouan, New Cairo. Post address: P.O. Box 417, Cairo,

Superintendent of Explosives Laboratory and Magazines, etc. Egyptian Government Servant. Indulges in Metallography as a hobby. Member of Society of Chemical Industry; Institute of Metals. Contributor of Papers on "Metallography" and "Metallurgical Knowledge of Ancient Egyptians" to the Cairo Scientific Society.

A. Lucas.

W. B. Pollard.

Frank Hughes.

Jones, Hilton Ira,

Mitchell, S. Dakota, U.S.A.

Head of Department of Chemistry, Dakota Wesleyan University. Warren Fund Scholar, Harvard University; Fellow in Chemistry, University of Chicago; Fellow and Treasurer, Oklahoma Academy of Science. Author of "Oklahoma Asphalt"; Thermometric Conversion" in *School Science and Mathematics*; "A New Method of Estimating Vanillin," etc.

Alexander Smith.

J. Livingston R. Morgan.

Alan W. C. Menzies.

F. J. Metzger.

S. A. Tucker.

Paget, Ferrand,

Bombay Burmah Trading Corp., Ltd., Bangkok, Siam.

Engineer; G.I.Mech.E. Four years training in Inorganic and Metallurgical Chemistry at The Northern Polytechnic Institute and Erith Technical Institute. I am an Assoc. Member of the British Foundrymen's Association, and was for some time Assist. Metallurgist to Messrs. Fraser Chalmers, Ltd., Erith, Kent, and also Chemist to the G.W. Explosives Syndicate, Ltd., London. I am immensely interested in Chemical Research and am desirous of keeping in touch with advancements of the Science during my stay in the Far East.

Arthur C. Claudet.

W. H. Mills.

Arthur J. Chapman.

Thomas Girtin.

Harley F. Knight.

Pougnet, Julien Pierre Frédéric,

Natal Estates Ltd., Mount Edgecombe, Natal, S. Africa.

Chemist and Factory Manager. I wish to keep in touch with the progress of Chemistry.

A. H. Finnis-Wheldon.

G. N. Martin.

L. Ernest Rouillard.

W. T. A. Edwards.

Rai, Kali Prosonuo,

147, Baranoshee Ghose Street, Calcutta.

Assistant in the Laboratory attached to Indian Museum, Botanical Survey Dept., Govt. of India. M.A. (Allahabad). Late Chemical Assistant under the Imperial Agricultural Chemist at Pusa Research Institute, and under the Agricultural Chemist at Sabour Agricultural College.

David Hooper.

Dhirendranath Mitra.

G. D. Hope.

B. C. Chatterji.

Watson, Thomas,

1186, Davie Street, Vancouver, B.C.

Analytical Chemist. Three years Assistant, Chem. Dept., University, Liverpool, England; 2 years Analyst, J. Bibby & Sons, Oilmillers, Liverpool, England; 1 year Demonstrator, Liverpool College, Shaw St., England; 6 years Analyst, Messrs. The Albion Oilcake Manufs., Liverpool, England; 3 months Analytical Chemist, c/o G. S. Eldridge & Co., 426 Richards St., Vancouver, B.C.

Arthur A. Dallman.

Thomas J. Roberts.

George Tate.

F. H. Sharpe.

Williams, Cornelius,

School of Agriculture, Cedara, Natal.

Analytical Chemist to the Union Department of Agriculture and Lecturer in Chemistry at the Cedara School of Agriculture; 1. Bachelor of Science of the London University; 2. Associate of the Royal College of Science, London; 3. Science Lecturer at the Calne Secondary School and Technical Institute, Wilts, 1901-8; 4. House Master and Lecturer at the Cedara School of Agriculture, Natal, 1909-10; 5. Analytical Chemist to the Dept. of Agriculture, Natal, and Lecturer in Chemistry at the Cedara School of Agriculture, from January, 1911.

J. S. Jamieson.

A. B. Tonkin.

B. M. Narbeth.

H. H. C. Puntan.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29.

No. 415.

Thursday, May 1st, 1913, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the death, on April 10th, of Mr. John Hunter, of Edinburgh, who was elected a Fellow on February 1st, 1883.

Dr. J. Newton Friend was formally admitted a Fellow of the Society.

Certificates were read for the first time in favour of Messrs.:

Archibald Joseph Brooks, Melrose, St. Lucia, B.W.I.

Jack Cecil Drummond, B.Sc., 8, Little Heath, Old Charlton, Kent.

Horace Freeman, 1535, Robson Street, Vancouver, B.C.

James Joseph Hutchinson, Cecilville, Conquer Hill, Dollymount, Co. Dublin.

Marius Maxwell, 77, Lawrie Park Road, Sydenham.

Percy Bernard Phillips, The London Hospital, E.

William Gilbert Saunders, 34, Hanover Street, Liverpool.

Montagu George Smith, 8, Cross Road, Bromley Common, Bromley, Kent.

Ebenezer Rees Thomas, M.Sc., Emmanuel College, Cambridge.

John Stewart Walker, c/o The Japanese Explosives Co., Ltd., Hiratsuka, Sagami, Japan.

Edwin Longstaff Watson, Nawabganj, Cawnpore, India.

Of the following papers, those marked * were read:

***119. "Bismuthinitrites."**

By Walter Craven Ball and Harold Helling Abram.

In continuation of previous work (T., 1905, 87, 761; 1909, 95, 2126; 1910, 97, 1408) the authors have obtained and examined the following bismuthinitrites, of the formula $X_2YBi(NO_2)_6$, where $X = Cs, Rb, K, (NH_4)$ and Tl , and $Y = Ag, Li$, and Na : *Caesium silver*, $Cs_2AgBi(NO_2)_6$; *rubidium silver*, $Rb_2AgBi(NO_2)_6$; *potassium silver*, $K_2AgBi(NO_2)_6$; *ammonium silver*, $(NH_4)_2AgBi(NO_2)_6$; *thallium silver*, $Tl_2AgBi(NO_2)_6$; *caesium lithium*, $Cs_2LiBi(NO_2)_6$; *rubidium lithium*, $Rb_2LiBi(NO_2)_6$; *potassium lithium*, $K_2LiBi(NO_2)_6$; *ammonium lithium*, $(NH_4)_2LiBi(NO_2)_6 \cdot H_2O$; *thallium lithium*, $Tl_2LiBi(NO_2)_6$, and *thallium sodium*, $Tl_2NaBi(NO_2)_6$.

The caesium sodium, rubidium sodium, and ammonium sodium salts have been previously described in the above-mentioned papers. These salts are red, yellow, or brown, and highly crystalline. Salts containing only one metal in addition to bismuth have been obtained, in which $X = Cs, Rb$, or Tl (the corresponding potassium salt, $K_3Bi(NO_2)_6 \cdot H_2O$, had been described earlier; see above). These are less stable than the X_2Y salts, and crystallise in a different form.

Bismuthinitrites containing nickel, together with any of the metals represented above by X , have also been obtained. Some alkaloidal bismuthinitrites have also been examined.

***120. "Constitution of aliphatic diazo-compounds."**

By Martin Onslow Forster and David Cardwell.

In the hope of distinguishing between the rival formulæ for the aliphatic diazo-compounds, the behaviour of diazocamphor and diazodeoxybenzoin towards the Grignard agents has been studied, the results being in favour of Thiele's formula. *Camphorquinone- α -methylhydrazone*, $C_{11}H_{18}ON_2$, is colourless, melts at $133-134^\circ$, and has $[\alpha]_D^{20} 367.5^\circ$, whilst the *β -methylhydrazone* is yellow, melts at 46° , and has $[\alpha]_D^{20} 296^\circ$; *benzilmethylhydrazone*, $C_{15}H_{14}ON_2$, melts at 138° .

The action of magnesium phenyl bromide on diazocamphor gives camphorquinone- α -phenylhydrazone, whilst diazodeoxybenzoin is converted into a *formazyl derivative*, $C_{27}H_{22}ON_4$, accompanied by triphenylcarbinol; the substance is intensely red, melts at 152° , and when oxidised with ferric chloride yields 1:4-diphenyl-1:2:3:5-tetrazole, together with benzoic acid.

*121. "The influence of temperature and pressure on the rate of volatilisation of zinc and of cadmium." By Theketh Kumaran Nair and Thomas Turner.

Practical tests show that a small residual pressure considerably raises the distillation temperature of zinc. The rate of volatilisation has therefore been determined, the method being to observe the loss with unit weight in fixed time (thirty minutes). Experiments were conducted with zinc in air, hydrogen, and carbon monoxide at selected pressures, and also with cadmium in air. Curves have been obtained showing the percentage of metal volatilised at temperatures and pressures covering a wide range.

The whole of the curves are parallel straight lines throughout the greater portion of their length, and it is found that:

1. A certain definite temperature is required in order to give readily appreciable volatilisation.

2. This critical temperature is raised by gaseous pressure, the effect of small additions being most marked.

3. When this critical temperature has once been reached, the rate of volatilisation is independent of the initial pressure, or the nature of the gas, but it varies directly as the increase of temperature.

4. Carbon monoxide raises the initial temperature slightly less than air, and hydrogen less than carbon monoxide, although at low pressures the differences are too small to be of much practical importance.

5. The pressure temperature curve for equal rate of volatilisation is steep from 0 to 50 mm.; after an abrupt change in direction, at 50 mm., it becomes a straight line from 80 mm., and much less steeply inclined. The straight lines for zinc and cadmium in this case are not parallel.

6. The last mm. of pressure has seventy times the effect in lowering the temperature of effective distillation as compared with the removal of 1 mm. when starting from any pressure above 50 mm.

*122. "Dinaphthathioxin and isodinaphthathioxin."

By Thomas Joseph Nolan and Samuel Smiles.

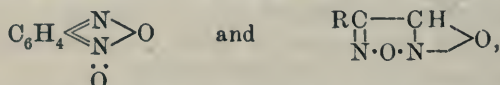
It was shown that by dehydration of β -naphthol sulphide and *iso*- β -naphthol sulphide, two different naphthathioxins are respectively formed. In chemical behaviour these resemble one another very closely, but they each give rise to a distinct set of derivatives, those examined being the dichloro- and dibromo-compounds and

the oxide and dioxide. It was also shown that isonaphthathioxin is closely related to β -naphthasulphonium-quinone. The constitution of these substances was also discussed.

*123. "Constitution of furoxans (dioxime 'peroxides')." *Chem. Ber.* 1906, 39, 1125.

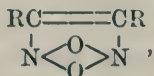
By **Martin Onslow Forster** and **Matthew Felix Barker**.

Green and Rowe (T., 1912, **101**, 2452) have recently pointed out that the supposed dinitroso-hydrocarbons of the aromatic series, recognised as dioxime "peroxides" by Forster and Fierz (T., 1907, **91**, 1942), are actually furoxans (oxides of furazan), probably similar in constitution to the aliphatic derivatives described by Wieland and Semper (*Annalen*, 1907, **358**, 36). The particular oxide of furazan adopted by Green and Rowe, however, like the one previously advocated by Wieland and Semper, namely:



respectively, conflicts with the observation (Forster and Fierz, *loc. cit.*) that when 1:2-nitronaphthylazoimide and 2:1-nitronaphthylazoimide are heated, elimination of nitrogen leads to the same dioxime "peroxide" in each case, an origin which points unmistakably to a symmetrical constitution.

Owing to the possibility of this case being influenced by steric conditions, the present authors have inquired whether the change in question is independent of the naphthalene nucleus, and have meanwhile arrived at the conclusion that the structure of these materials may be expressed more satisfactorily by the symmetrical formula :



which accounts adequately for their behaviour.

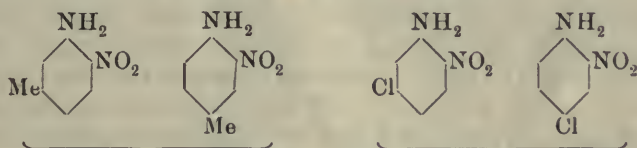
124. "Constitution of oxadiazole oxides (furan oxides or dioxime peroxides)." By Arthur George Green and Frederick Maurice Rowe.

The compounds originally described as "dinitroso-compounds" were regarded later by Forster and Fierz as *o*-quinonedioximes, $\text{X} \begin{smallmatrix} \text{N}\cdot\text{O} \\ \diagdown \\ \text{N}\cdot\text{O} \end{smallmatrix}$ (T., 1907, **91**, 1942). The new method of formation recently published by the authors (T., 1912, **101**, 2452) appeared

to support the unsymmetrical structure, $X \begin{smallmatrix} \text{N} \\ \text{N} \end{smallmatrix} > \text{O}$, but is opposed

to the observation of Forster and Fierz, that the compound $\text{C}_{10}\text{H}_6\text{O}_2\text{N}_2$ is obtained by heating either 1:2-nitronaphthylazoimide or 2:1-nitronaphthylazoimide.

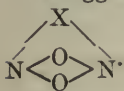
The authors have now submitted to oxidation with alkaline sodium hypochlorite the two pairs of isomerides:



Nitrotoluidines, m. p. 109° and 114° . Chloronitroanilines, m. p. 125° and 116° .

and have found that one product is obtained from the two isomerides in each case, namely, from the first pair a methylbenzoxadiazole oxide (tolufurazan oxide) melting at 97° , and from the second pair, a chlorobenzoxadiazole oxide (chlorobenzofurazan oxide) melting at 48° .

The symmetrical structure of these substances is thus established, but in view of various objections to the dioxime-peroxide formula, it is suggested that the compounds in question have the constitution



This would explain their formation from the nitro-

amines without requiring the transference of an oxygen atom from the nitro-group, and would better represent their chemical properties.

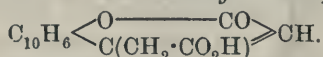
125. "The estimation of zinc as zinc ammonium phosphate and zinc pyrophosphate." By Thomas Matthew Findley and Alexander Charles Cumming.

The phosphate method for the estimation of zinc has been investigated in order to find the reason for occasional unsatisfactory results. It was found that the results were inaccurate (1) if the solution contained more than a trace of acetic acid; (2) if the solution, after the precipitation, was alkaline; or (3) if the solution contained sodium or potassium salts. The method can be modified to give correct results in the presence of sodium and potassium.

126. "Condensation of acetonedicarboxylic acid with phenols."

By Biman Bihari Dey.

When acetonedicarboxylic acid is condensed with α -naphthol under suitable conditions in the presence of concentrated sulphuric acid, *methyl- α -naphthacoumarincarboxylic acid*,



is obtained in almost quantitative yield; it melts at 214° , and on recrystallisation from boiling alcohol passes into a second modification, melting at 181.5° . These are isomeric, and when kept for some time at a few degrees above their respective melting points, give off carbon dioxide and pass into methyl- α -naphthacoumarin (Bartsch, *Ber.*, 1903, **36**, 1966). β -Naphthol, under similar conditions, forms the corresponding *methyl- β -naphthacoumarincarboxylic acid*, melting at 192.5° , and passing into methyl- β -naphthacoumarin (m. p. 180°).

Pyrogallol, under similar treatment, yields the compound, $\text{C}_{11}\text{H}_8\text{O}_6$, crystallising from boiling water or alcohol in small, colourless needles, melting at 215° , and passing into the compound, $\text{C}_{10}\text{H}_8\text{O}_4$ (m. p. 235°), with loss of carbon dioxide.

p-Cresol and orcinol yield the compounds, $\text{C}_{12}\text{H}_{10}\text{O}_4$ and $\text{C}_{12}\text{H}_{10}\text{O}_5$, melting at 185° and 262° respectively.

127. "Oxidation of sphingosin." By Arthur Lapworth.

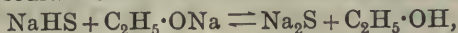
Sphingosin, $\text{C}_{17}\text{H}_{35}\text{O}_2\text{N}$, has recently been shown to be an unsaturated dihydroxy-derivative of a primary amine (Thomas and Thierfelder, *Zeitsch. physiol. Chem.*, 1912, **77**, 511; Levene and Jacobs, *Proc. Amer. Soc. Biol. Chem.*, 1911, xxix; *J. Biol. Chem.*, 1912, **11**, 547).

The author finds that sphingosin, purified through the sulphate, is readily oxidised by chromic acid dissolved in glacial acetic acid, yielding pure *n*-tridecylic acid, $\text{CH}_3 \cdot [\text{CH}_2]_{11} \cdot \text{CO}_2\text{H}$. The acid was identified by the usual modes of direct comparison with a specimen of *n*-tridecylic acid, prepared from α -hydroxymyristic acid, and was also converted into its α -bromo- and α -hydroxy-derivatives, which agreed in all respects with the descriptions given by Le Sueur (*T.*, 1905, **87**, 1905).

128. "The conversion of sodium hydrosulphide into sodium monosulphide." By John Smeath Thomas and Alexander Rule.

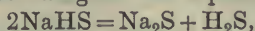
The authors have made use of pure anhydrous sodium hydrosulphide, prepared by the action of hydrogen sulphide on sodium

ethoxide (T., 1911, **99**, 558). The reaction between sodium hydrosulphide and sodium ethoxide in alcoholic solution is reversible:



and mixtures of hydrosulphide and monosulphide are obtained as products of the reaction. By increasing the concentration of sodium ethoxide, it was found possible to convert the hydrosulphide completely into the monosulphide, but the reaction does not form a suitable method for the preparation of anhydrous sodium monosulphide, owing to difficulties of separation. An alcoholate of sodium monosulphide, $\text{Na}_2\text{S}\cdot\text{C}_2\text{H}_5\cdot\text{OH}$, was described.

The dissociation of the hydrosulphide into the monosulphide by the action of heat, according to the equation:



is complicated by a secondary reaction owing to the dissociation, in turn, of hydrogen sulphide, and the action of the sulphur so produced on the hydrosulphide with the formation of polysulphides. The yellow coloration which takes place when the hydrosulphide is heated above 100° , not only in air, but also in hydrogen, hydrogen sulphide, etc., is thus explained.

By heating the hydrosulphide very gradually in a vacuum, and absorbing the hydrogen sulphide evolved, the authors succeeded in bringing about the complete dissociation of the hydrosulphide into the monosulphide below 500° , without the formation of any appreciable amount of polysulphide.

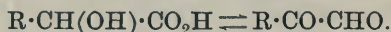
129. "Condensation of camphorquinone with phenols."

By Hemendra Kumar Sen-Gupta and Biman Bihari Dey.

Camphorquinone condenses with phenol in presence of fuming hydrochloric acid to give a compound, $\text{C}_8\text{H}_{14}\text{C}(\text{C}_6\text{H}_4\cdot\text{OH})_2$, melting at 239.5° , and crystallising from glacial acetic acid in colourless, prismatic needles. The *acetyl* derivative melts at 166° , the *benzoyl* derivative at 185° , the *dimethyl ether* at 144° , and the *dinitro*-derivative at 223° . Similar condensations have also been effected with *o*-cresol and catechol; the *o*-cresol compound melts at 241° , and yields a *dinitro*-derivative melting at 270° , a *diacetyl* derivative melting at 208° , and a *dimethyl ether* melting at 197° . The *catechol* compound crystallises from acetone in rosettes of small, colourless needles, decomposing at about 250° ; the *dimethyl ether* melts at 165° .

130. "The interconversion of α -hydroxy-acids and α -ketonic aldehydes: a reversible reaction." By Henry Drysdale Dakin and Harold Ward Dudley.

The conversion of α -ketonic aldehydes into α -hydroxy-acids by the action of alkali has long been known, and may also be effected by enzyme action (*J. Biol. Chem.*, 1913, **14**, 155). The authors have succeeded in showing that the reverse change may take place. An aqueous solution of lactic acid, containing *p*-nitrophenylhydrazine, on keeping, slowly deposits methylglyoxaldinitrophenylhydrazone, crystallising from nitrobenzene in scarlet needles, and melting and decomposing at about 300°. A similar reaction takes place with glycollic and mandelic acids:



The formation of methylglyoxal from lactic acid is of interest in connexion with the relationship between lactic acid and dextrose in carbohydrate metabolism in plants and animals.

131. "The bacterial oxidation of phenol."

By Gilbert John Fowler and Ernest Moore Mumford.

Following the work of Fowler, Ardern, and Lockett (*Proc. Roy. Soc.*, 1910, **83**, B, 149), the authors have endeavoured to identify the products of fermentation and to follow the course of the reaction, when phenol is oxidised by the action of *B. Helvolus*. A solution, amounting in volume to 2 litres, containing 25 parts per 100,000 of phenol, was inoculated with an active culture of *B. Helvolus*, and continuously aerated for many weeks, any carbon dioxide evolved being collected in U-tubes filled with soda-lime.

Precautions were taken to prevent access of other organisms, or of carbon dioxide from the air, into the solution, to maintain a constant temperature and constant strength of solution, and to prevent moisture from entering the weighed soda-lime tubes.

The total weight of carbon dioxide evolved corresponded closely with one-sixth of the total carbon present as phenol, indicating that only one carbon atom was oxidised to carbon dioxide.

The liquid, after fermentation, was found to be faintly acid, and to give a white precipitate with baryta water. This precipitate was collected, washed with a little water, a little cold alcohol, and dissolved in boiling alcohol. From this solution a small quantity of the pure barium salt was prepared, and this, on analysis, gave $\text{Ba} = 43\cdot53$, which corresponds closely with the percentage present in barium trihydroxyglutarate, namely, 43\cdot49.

The work is being continued with the object of obtaining a larger quantity of the product of fermentation, and investigating its properties more fully.

Other phenolic derivatives are being studied by the authors and their co-workers, in the hope of arriving at a general conclusion as to the mechanism of such oxidation processes.

**132. "The vapour pressures of binary mixtures. Part II. The partial pressure of glyceryl trinitrate in solution in acetone."
By Arthur Marshall.**

In Part I (T., 1906, **89**, 1350) the possible types of vapour-pressure curves were discussed and enumerated, a method of ascertaining the partial-pressure curves from the total-pressure curve was described, and experimental determinations of the total pressures of various mixtures were given, amongst others those of solutions of glyceryl trinitrate (nitroglycerine) in acetone. The curve is of the type to which the author has assigned the designation Ia.

One of the peculiarities of this case is that the vapour pressure of acetone is about 160,000 times as great as that of glyceryl trinitrate, and consequently the partial-pressure curve of acetone is identical with the total-pressure curve. This, however, in no way interferes with the calculations to ascertain the form of the partial-pressure curve of glyceryl trinitrate; on the contrary, it makes the calculations somewhat easier.

The problem is of some practical importance, as it throws a light on the losses of nitroglycerine, which are liable to occur in the drying of explosives, such as cordite, which contain the two substances. It is usual nowadays to recover part of the acetone used in the manufacture of explosives by drawing air from the stoves through pipes to a suitable recovery plant. These calculations give an indication of the relative amounts of nitroglycerine, which may condense in the pipes and other parts of the plant in the different stages of the drying. Such condensation is, of course, troublesome on account of the explosibility of the substance and the special precautions that have to be adopted to deal with the condensate. The complete elucidation of this problem would, however, also require determinations of the vapour pressures of mixtures of gun-cotton and acetone, and these are not available.

The calculations are based on Duhem's equation:

$$\frac{dp_1}{dx} \frac{x}{p_1} - \frac{dp_2}{dx} \frac{1-x}{p_2}$$

in which p_1 and p_2 are the two partial pressures, and x is the molecular proportion in the liquid phase of the first substance, in

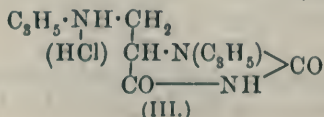
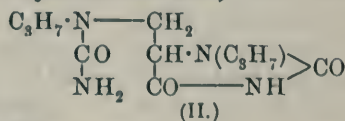
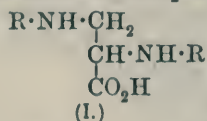
this case acetone. For any value of x , p can be obtained from a curve, as also can the differential dp_1/dx . The value of $p_2 \cdot dx/dp_2$ is then found by calculation, and the separate values of p_2 and dp_2/dx are obtained by a process of trial and error. The whole course of the partial-pressure curve is thus gradually ascertained.

This has been carried out for the pair of substances under consideration, with the results shown in the table below. The temperature of the measurements was 18° . At this temperature the vapour pressure of glyceryl trinitrate is estimated to be equal to about 0.001 mm. of mercury.

x (acetone).	p_1 (acetone).	dp_1/dx .	$p_2 \cdot 10^5$ (glyceryl trinitrate).	$-dp_2/dx \cdot 10^5$.	Glyceryl trinitrate in liquid phase, per cent.
0	0	—	100	100	100
0.1	8.2	90	89.5	109	97.2
0.2	18.4	106	78.4	113	94.0
0.3	29.5	116	67.1	113	90.1
0.4	41.5	131	55.6	117	85.4
0.5	55.7	149	43.9	117	79.7
0.6	71.3	171	31.4	113	72.3
0.7	90.0	205	20.4	108	62.6
0.8	112.2	255	10.2	93	49.4
0.9	141.0	280	3.0	72	30.3
1.0	162.0	162	0.0	—	0.0

133. "Carbamido- and other derivatives of $\alpha\beta$ -dipropylamino- and $\alpha\beta$ -diallylamino-propionic acids." By Edward Percy Frankland and Henry Edgar Smith.

The authors have prepared hydrobromic and nitric acid salts as well as mononitroso-derivatives of the hitherto unknown $\alpha\beta$ -dipropylamino- and -diallylamino-propionic acids (I). The hydrobromic acid salts were obtained in a yield of 60 and 51 per cent. respectively by heating the amines with dibromopropionic acid in alcoholic solution. The dipropylamino-acid was converted into 1:7-dipropyl-tetrahydrouic acid (II), and the diallylamino-acid into γ -allyl-aminomethyl- β -allylhydantoin hydrochloride (III) by the reactions described by E. P. Frankland (T., 1910, **97**, 1686) in the case of the corresponding benzyl derivatives (addition of cyanic acid and dehydration with 25 per cent. hydrochloric acid):



134. "The relative activities of certain organic iodo-compounds with sodium phenoxide in alcoholic solution. Part I. Some normal primary-alkyl iodides." By David Segaller.

The author has made a series of measurements of the velocity-coefficients of the interaction of the normal primary alkyl iodides and sodium phenoxide in alcoholic solution. The following homologues were dealt with: methyl, ethyl, propyl; butyl, amyl, hexyl, heptyl, octyl, and cetyl iodides. With the exception of amyl iodide, the velocity-coefficients were found to decrease with increasing molecular weight, very rapidly from methyl to butyl iodides, and then very gradually. The coefficient for amyl iodide is very much lower than would have been expected.

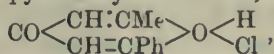
135. "An attempt to resolve an oxonium salt." By Stanley Isaac Levy, Eric John Holmyard, and Siegfried Ruhemann.

Since it has long been known that organic compounds can be obtained in which oxygen functions as a quadrivalent element, it seemed to be of interest to attempt the preparation of salts of oxonium compounds of which the molecules have no plane of symmetry, with a view to the preparation of optically active derivatives, in which the activity arises wholly or in part from the asymmetry of the oxonium group. 2-Phenyl-6-methyl-4-pyrone (Ruhemann, T., 1908, **98**, 431) appeared especially suitable for this purpose, since it forms a stable hydrochloride which is not hydrolysed in aqueous solution.

The hydrochloride of this base was accordingly prepared in the pure state, and treated with silver *d*-bromocamphorsulphonate.

Attempts were made to effect a resolution of the 2-phenyl-6-methyl-4-pyrone *d*- α -bromocamphor- π -sulphonate which was obtained into the two forms which should be theoretically possible, but owing to the small quantities available, no definite conclusions could be drawn. The values obtained, however, indicate that interesting results should be forthcoming with larger quantities, and the authors hope to resume the work at a later date.

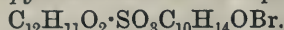
2-Phenyl-6-methyl-4-pyrone hydrochloride,



(*loc. cit.*, p. 434), is obtained when dry hydrogen chloride is passed into a solution of the pure base in absolute ether. The faintly-yellow solid which separates is collected, and freed from ether and hydrogen chloride by being kept for several days in a vacuum over sulphuric acid and soda-lime. The compound is very readily soluble

in water, alcohol, or hot acetone, crystallising from the latter in radial aggregates of needles, which, on heating, begin to soften at 125°, and melt and decompose to a dark red liquid at 165—170°.

2-Phenyl-6-methyl-4-pyrone d-α-Bromocamphor-π-sulphonate,



When the calculated quantity of silver *d-α*-bromocamphor- π -sulphonate (m. p. 145°, decomp.), dissolved in absolute alcohol, is added to a solution of the pyrone hydrochloride in the same solvent, an immediate precipitate of silver chloride is obtained. After its removal, the clear alcoholic filtrate is evaporated to dryness at 30° in a vacuum; the greyish-white residue is moderately soluble in hot acetone, from which it separates readily on cooling in colourless prisms, which begin to darken at about 90°, and melt completely to a deep red liquid at 160°:

0.2106 gave 0.4112 CO₂ and 0.0948 H₂O. C=53.25; H=5.00.

C₂₂H₂₅O₆SBr requires C=53.12; H=5.03 per cent.

136. "The spontaneous crystallisation of solutions of potassium chloride, bromide, and iodide." By Bernard Mouat Jones and Popatlal Govindlal Shah.

The supersolubility curves for the solutions of potassium chloride, bromide, and iodide, and for the ice-phase in every case, have been traced, using the methods previously employed. The "metastable ranges" are about 10°, 12°, and 3° for the chloride, bromide, and iodide respectively. The vigour of the shaking was varied through a considerable range, and found to have little or no effect on the temperature of crystallisation. The rate of cooling of the tubes, so long as it was not quicker than 1° in about ten minutes, was found to have no appreciable effect on the crystallising temperature. The bearing of the work of Young (*J. Amer. Chem. Soc.*, 1911, **33**, 148) on the mechanical stimulus to crystallisation upon the significance of the supersolubility curves was discussed.

137. "The absorption spectra of some derivatives of the nitroaminophenols in relation to their constitution." By Raphael Meldola and John Theodore Hewitt.

The authors have examined the absorption spectra of picramic and isopicramic acids in alcoholic, acid, and alkaline solutions. A comparison has been instituted with 2:3:5- and 2:3:6-trinitroacetylaminobenzenes; the latter compounds, although containing no hydroxyl groups, give evidence of salt-formation with alkali of sufficient strength; this change is not accompanied by elimination of a nitro-group.

138. "Colours produced by tetranitromethane with compounds containing elements capable of showing change in valency." By Hans Thacher Clarke, Alexander Killen Macbeth, and Alfred Walter Stewart.

Ostromisslensky (*J. pr. Chem.*, 1911, [ii], **84**, 489) has shown that ethylenic compounds, when dissolved in paraffin hydrocarbons, give yellow colours with tetranitromethane. It appeared to the authors that this was probably a special case of a more general phenomenon, and experiments were therefore carried out to see if similar colorations were shown when tetranitromethane was allowed to react with compounds containing atoms of elements capable of showing a higher stage of valency. Thus, the sulphur atom in alkyl sulphides is bivalent, but is capable of becoming quadrivalent in the sulphonium compounds; and it was thought that since such an atom obviously contains a store of residual affinity, it might act in a manner similar to the unsaturated carbon atoms of ethylenic compounds. About thirty substances containing atoms of this type have been examined; and the prognostication has been found to be correct. The following results, among others, have been obtained.

The elements the compounds of which have been investigated are: bromine, iodine, nitrogen, phosphorus, sulphur, and oxygen; and in certain cases compounds have been chosen which contained more than one atom of the elements in question.

The method employed was to dissolve the substance to be tested in chloroform (about 0.1 gram in 5 c.c.), and add to this a very dilute solution of tetranitromethane in chloroform.

It was found that the violet tint of a chloroform solution of iodine was changed to brown by the addition of tetranitromethane. There does not seem to be much of importance in this, however, as the formation of the usual brown oxonium complex would explain the occurrence of the colour without the need for any further assumptions. Ethyl iodide, on the other hand, gives a greenish-yellow tint, which does not appear to be due to the presence of free iodine, as it is not removed by shaking the solution with aqueous sodium thiosulphate solution. Ethyl bromide shows no marked colour change with tetranitromethane. This is in agreement with the original hypothesis, since bromine is much less ready to produce stable compounds of higher valency than is iodine, as witness the formation of the iodonium derivatives, which have no analogues among bromine compounds.

With regard to phosphorus, it was found that triethylphosphine yields a deep yellowish-brown tint. Benzylphosphine shows a somewhat similar colour; but in this case the presence of the benzene

nucleus alone might have been sufficient to bring the coloration into existence.

Taking nitrogen next, Ostromisslensky had already observed that dimethylaniline gave a dark tint with tetranitromethane. The authors have examined various groups of nitrogen derivatives. Amides, such as acetamide, formamide, and carbamide, show no colour. Amino-derivatives appear to differ from each other to some extent. Ethyl β -aminocrotonate gives a deep yellow tinge which may, however, be due to the ethylenic bond; acetaldehyde-ammonia produces a clear yellow colour, whilst urethane in alcoholic solution shows no coloration. The latter apparent anomaly may be accounted for if urethane is regarded as the amide of ethoxyformic acid. Among the cyclic nitrogen derivatives, methylpiperidine gives a golden-yellow tinge.

Turning to sulphur derivatives, the following results were obtained. Alkyl sulphides show yellow tinges; propyl sulphide, for example, produces a deep golden-yellow colour; whilst ethyl thiodiglycollate gives a very pale yellow. Ethylthetine shows no colour when mixed with tetranitromethane in chloroform solution; on keeping for a day or two a yellow tint is produced, but this appears to be due to tetranitromethane decomposition products. It is safe to say that under the conditions of the experiment, bivalent sulphur atoms produce a colour, whilst quadrivalent ones are inactive. Pentamethylene sulphide, in which the sulphur atom is a member of a ring, gives the same golden-yellow tint as do open-chain sulphides. Thiocarbamide in alcoholic solution reacts violently with tetranitromethane, and gives a yellow colour. The origin of this reaction might be sought in the presence of traces of nitrous fumes liberated from the tetranitromethane; but no analogous reaction was observed with carbamide. Thioacetic acid shows no colour, but thioacetamide gives a pale golden-yellow. Acetothienone shows a very faint discoloration.

A comparison of the results leads to an interesting point. Acetic acid and thioacetic acid show no colours, so that the conjugation of a carbonyl oxygen with a hydroxylic oxygen or a sulphur atom of the $-SH$ group evidently has no colour-producing effect. Again, acetamide and carbamide also give no tints, so that the conjugation of carbonyl oxygen with the amide nitrogen is also not sufficient to give rise to colour. On the other hand, both thioacetamide and thiocarbamide yield yellow tints, which appears to indicate that in their case there is sufficient free residual affinity in the molecule. This agrees with the fact that sulphonium derivatives are much more stable than oxonium ones, which is probably due to the greater residual affinity of the bivalent sulphur atom.

Among the oxygen derivatives, the results at first sight appear to be anomalous. Ether, dimethylpyrone, and lactide give no colour; pentamethylene oxide gives a very faint discoloration. On the other hand, 1:4-dioxan shows a yellow tinge. It is clear from this that the presence of a second non-carbon atom in the six-membered ring of 1:4-dioxan is capable of enhancing the properties of the first one, as Clarke (T., 1912, 101, 1788) has shown to be the case in a recent quantitative investigation.

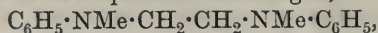
The results for a group of six-membered cyclic substances containing all permutations of two atoms of sulphur, oxygen, and nitrogen are shown in the table below (the non-carbon atoms are placed in brackets for convenience):

Pentamethylene oxide.....	(O)	Faint discoloration
sulphide	(S)	Golden yellow
Methylpiperidine.....	(N)	,,
1:4-Dioxan	(O,O)	Pale ,,
1:4-Dithian.....	(S,S)	Lemon ,,
1:4-Dimethylpiperazine	(N,N)	Reddish-brown
Methylmorpholine	(N,O)	Golden yellow
1:4-Methylthiazan	(N,S)	,,
1:4-Thioxan	(O,S)	Lemon ,,

A comparison of these tints brings out the following. A single etheric oxygen atom yields a practically negligible tint, but when the more highly unsaturated sulphur and nitrogen atoms are employed, marked tints are produced by the corresponding substances. Secondly, two etheric oxygen atoms, when conjugated with one another in the 1:4-positions in the ring, are able so to reinforce each other as to produce a colour, although a very pale one. Thirdly, when the more basic atoms of sulphur or of nitrogen are conjugated together there is produced a deepening of tinge, the reagent giving a lemon-yellow coloration in the dithian, and brown in the dimethylpiperazine. Obviously, in these compounds, the depth of tint bears some relation to the amount of residual affinity on the atoms involved. Finally, the conjugation of a strongly basic atom, nitrogen, with a less basic one, oxygen or sulphur, produces a golden-yellow colour, whereas when two weakly basic atoms, sulphur and oxygen, are conjugated, the less intense lemon-yellow tint is obtained. From these results, it appears as if this reaction might form a rough and ready way of estimating the amount of residual affinity in compounds containing atoms of this type.

A comparison of cyclic substances with the corresponding open-chain derivatives shows that very little change takes place in the tints when the ring is opened. 1:4-Thioxan and the corresponding open-chain compound, having the formula $\text{MeS}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{OMe}$,

both give lemon-yellow colours. Similarly, diphenylpiperazine gives a brown tint, whilst the open-chain analogue,



produces a brown tint which rapidly changes to dark green.

From the foregoing, it appears evident that the results obtained by Ostromisslensky in the case of ethylenic substances are merely a particular case of a more general phenomenon. The carbon atoms in the ethylenic bond are not fully saturated, and are therefore to be considered as analogous to those of other elements which are capable of altering their valency to a higher grade. This investigation is being continued by means of the spectrograph; and it is hoped that the results will shortly be communicated.

139. "Note on the oil of the fruits of *Alpinia alba*, Rosc." By Samuel Shrowder Pickles and John Campbell Earl.

A small quantity of the fruits of *Alpinia alba*, Rosc. (*Amomum medium*, Lour.) was received at the Imperial Institute from Hong Kong in 1911. The fruits, on examination, were found to contain a volatile oil, which occurred almost entirely in the seeds.

By distilling the fruits with steam, about 1 per cent. of a pale yellow oil, having an odour recalling those of lemon and eucalyptus, was obtained. The following constants were found for the oil: D_{20}^{25} 0.9366, α_D (in a 1-dcm. tube at 20°) $-2^\circ 15'$.

The oil, of which only 70 c.c. were available, was shaken, first with dilute sodium carbonate, next with sodium hydrogen sulphite solution, then with dilute sodium hydroxide, and finally with 50 per cent. resorcinol solution to absorb cineole.

From the results of this treatment and the subsequent examination of the various products, the composition of the oil was found to be approximately as follows:

Cineole, 69 per cent.; characterised by the crystalline additive product with iodol.

Aldehydes and ketones, 27.5 per cent., consisting mainly of citral, which was characterised by means of the semicarbazones and the β -naphthacinchoninic acid.

Phenols, 1.5 per cent.

Acids, 1 per cent. A small quantity of a crystalline acid, m. p. 46–48°, was isolated, but not in sufficient quantity for identification.

The residue, amounting to about 1 per cent., seemed from its odour to consist chiefly of terpenes.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Claude, Georges. Liquid air, oxygen, nitrogen. Translated by *Henry E. P. Cottrell*. London 1913. pp. xxv + 418. ill. 18s. net. (*Recd.* 25/4/13.) From the Publishers: Messrs. J. & A. Churchill.

Stähler, Arthur. [Editor]. Handbuch der Arbeitsmethoden in der anorganischen Chemie. Vol. I. Leipzig 1913. pp. xii + 786. ill. M. 25. —. (*Reference.*) From the Publishers: Messrs. Veit and Co.

II. *By Purchase.*

Montamy, d'Arclais de. Traité des couleurs pour la peinture en émail et sur la porcelaine. Paris 1765. pp. lii + 287. (*Reference.*)

Neumann, Caspar. Chemical Works. Abridged and methodized; with large additions . . . by *William Lewis*. London 1759. pp. xvi + 586 + [xxxviii]. (*Reference.*)

Rutty, John. Methodical synopsis of mineral waters, comprehending the most celebrated medicinal waters, both cold and hot, of Great Britain, Ireland, France, Germany . . . and several other parts of the World. . . . Interspersed with tables. London 1757. pp. xvi + 660 + [viii]. (*Reference.*)

III. *Pamphlets.*

Curtius, Theodor, and Franzen, Hartwig. Ueber die chemischen Bestandteile grüner Pflanzen. Mitteilungen I.-V. (From the *Sitzungsber. Heidelberger Akad. Wiss.*, 1910, 1912.)

Holmberg, Bror. Ueber optisch aktive Dichlorbernsteinsäuren. (From the *Svensk Kem. Tid.*, 1912.)

Schär, Eduard. Ueber Reaktionen des Hydrocoerulignons. (From the *Schweiz. Woch. Chem. Pharm.*, 1912.)

Schilling, Cl., Krogh, M. von, Schrauth, W., and Schoeller, W. Die Wirkung organischer Quecksilberverbindungen bei Spirochäteninfektionen. (From the *Zeitsch. Chemotherapie u. verwandte Gebiete*, 1912, 1.)

Schmidt, Ernst, and Seeberg, A. Ueber das Neurinbromid. (From the *Apoth. Zeit.*, 1912.)

Schoeller, Walter, and Schrauth, Wal her. Neuere Anschauungen über den Chemismus der Gift- und Heilwirkung organischer Quecksilberverbindungen. (From the *Med. Klinik*, 1912.)

Schwarzkop, Paul. Beiträge zur Kenntnis der komplexen Eisen-cyanverbindungen mit besonderer Berücksichtigung der Bildung von

Nitroprussid. (From the *Abhandl. deut. naturwiss-med Ver. Böhmen*, 1911, 3.)

White, *Edmund*. Lecture on thorium and its compounds. Delivered before the Institute of Chemistry. London 1912. pp. 28.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, June 2nd, 1913.

All persons who received grants in June, 1912, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Monday, June 2nd, 1913.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is applied to investigations relating to problems connected with the coal-tar and allied industries.

VAN'T HOFF MEMORIAL LECTURE.

An Extra Meeting will be held on Thursday, May 22nd, 1913, at 8.30 p.m., when the van't Hoff Memorial Lecture will be delivered by Professor James Walker, F.R.S.

At the next Ordinary Scientific Meeting on Thursday, May 15th, 1913, at 8.30 p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Studies of dynamic isomerism. Part XV. The influence of light on isomeric change." By T. M. Lowry and H. R. Courtman.

"Derivatives of *o*-xylene. Part III. The presence of a mobile nitro-group in each of the two trinitro-*o*-xylenes." By A. W. Crossley and W. R. Pratt.

"Derivatives of *o*-xylene. Part IV. Synthesis of 4:5-dibromo-3-*o*-xlenol." By A. W. Crossley and S. Smith.

"Synthesis of unsymmetrical derivatives of deoxybenzoin." By J. C. Cain, J. L. Simonsen, and C. Smith.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29.

No. 416

Thursday, May 15th, 1913, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Reference was made to the death, on April 29th, 1913, of Mr. Matthew Algernon Adams, of Maidstone, who was elected a Fellow on February 15th, 1877.

The PRESIDENT announced that the Council have proposed the following gentlemen as Honorary and Foreign Members, and that a ballot for their election will be held at the next Ordinary Scientific Meeting on Thursday, June 5th:

Professor Dmitri Petrovitsch Konovaloff (St. Petersburg).

Professor Alfred Werner (Zürich).

The PRESIDENT also read the following statement which the Council have received with reference to the Van't Hoff Memorial Fund:

REPORT OF THE VAN'T HOFF COMMITTEE,
April 18th, 1913.

The united Committees of Amsterdam and Rotterdam have received up to the present a sum of Fl.56,000, about Fl.6,000 having been contributed by foreign countries. A sum of Fl.35,000 has been set aside to defray the cost of the statue to be erected in Van't Hoff's native town, Rotterdam, after the design of Mr. Charles van Wijk, of The Hague. It is hoped that the inauguration may take place during the course of 1915. After the expenses have

been deducted, the remainder will be allotted to the Van't Hoff Memorial Fund for the advancement of original research in pure and applied chemistry. Probably the Royal Academy of Science of Amsterdam will undertake to manage the capital and to assign the annual grants.

Certificates were read for the first time in favour of Messrs.:

William Rhys-Davies, Swan Arcade, Bradford.

Roy Gonçalves Glenday, B.A., Emmanuel College, Cambridge.

Victor Lefebure, B.Sc., 25, Belitha Villas, Barnsbury, N.

Duncan James Macnaughten, 31, Clonmel Road, Fulham, S.W.

Percy Cyril Lesley Thorne, B.A., Borough Road Training College, Isleworth.

Jeremiah Twomey, B.Sc., 21, Onslow Road, Elm Park, Liverpool.

Thomas Howard Young, 118, Scotia Street, Winnipeg, Canada.

Messrs. A. J. Ewins and H. Finnemore were elected Scrutators, and a ballot for the election of Fellows was held. The following were subsequently declared as duly elected:

John Percy Batey, M.Sc.Tech.

Horace George Battye.

George Frederick William Blackburn.

Edward Cahen.

Alexander Caruth.

Noël Guilbert Stevenson Coppin, M.Sc.

Arthur Ernest Crutchley.

Vasanji Premji Dalal, M.A., B.Sc.

Harold Davies.

Alfred Gilbert Dix, B.Sc.

Herbert Garland.

Fritz Haber.

Percy Wolmer Hill.

Harold Edward Pollock Hodsoll.

Thomas Arthur Holroyd, B.Sc.

Percy Hutchinson, B.Sc.

Hilton Ira Jones.

Darab Dinsha Kanga, M.A.

Douglas Rayment Keller, B.Sc.

Emmanuel Francis Kur.

Joseph Stuart Lawson.

Harold Charles Lloyd, B.Sc.

John Francis McCann.

Harry Bertram Maynard.

Bhaichand Anupchand Mehta, M.A.

Arthur George Abraham Miller, B.Sc.

Ferrand Paget.

Francis Martin Potter, B.Sc.

Julien Pierre Frederic Pougnet.

Kali Prosonuo Rai, M.A.

Arthur Samuel Robinson, B.Sc.

John Robert Ruffley.

Reginald William Rusby.

Hormusji Kharschedji Sahiar, M.A.

Sosale Garalapury Sastry, B.A.

Herbert Sutcliffe Shrewsbury.

William James Stansfield.

Thomas Watson.

Cornelius Williams, B.Sc.

Thomas Harrison Winstanley.

Clifton Wyver.

William John Young, D.Sc., M.Sc.

Of the following papers, those marked * were read:

- *140. "Studies of dynamic isomerism. Part XV. The influence of light on isomeric change." By Thomas Martin Lowry and Harold Reuben Courtman.

Several substances which readily undergo isomeric change on dissolution were exposed to the action of ultraviolet light by enclos-

ing the solutions in a silica polarimeter tube surrounded by a silica water-jacket and placed in close proximity to a silica mercury lamp. Of nine substances examined, only two showed any marked acceleration of isomeric change. In the case of aminomethylenecamphor the increase of velocity was confined to the period of exposure to light, but in the case of benzoylcamphor it persisted after the light was extinguished, as if some chemical catalyst had been produced in the solution.

***141. "Derivatives of *o*-xylene. Part III. The presence of a mobile nitro-group in each of the two trinitro-*o*-xylenes." By Arthur William Crossley and Walter Ryley Pratt.**

3:4:5-Trinitro- and 3:4:6-trinitro-*o*-xylenes each contains a mobile nitro-group occupying position 4 in the former and position 3 in the latter compound. The groups are replaced by the amino-group when treated with alcoholic ammonia (T., 1911, **99**, 2345), and it has now been found that many substituted amines behave similarly to ammonia. Derivatives have been prepared from the following primary amines: methylamine, ethylamine, aniline, *p*-toluidine, *o*- and *p*-anisidine, benzylamine, and, using the secondary amines, dimethylamine and piperidine. Ortho- and meta-nitroaniline and methylaniline appear to have no action on the trinitroxylenes, and although interaction takes place between both trinitroxylenes and diethylamine, also *p*-phenylenediamine, only resinous products and no crystalline derivatives could be obtained.

It is interesting to note that the mobile group in 3:4:5-trinitro-*o*-xylene is situated ortho- to the two other nitro-groups, whereas in 3:4:6-trinitro-*o*-xylene it is ortho- to one and para- to the other, both positions which, as already noticed, seem especially favourable to replacement.

DISCUSSION.

Dr. FLÜRSCHHEIM confirmed Prof. Crossley's conclusion that the mobility of a nitro-group in 3:4:5-trinitro-*o*-xylene should even be exceeded in tetranitroaniline. He agreed with the President's view that this fact could not be entirely accounted for by the influence of the additional nitro-group in the para-position to the mobile group, since the effect of a para-nitro-group would be small in comparison with that exercised by the two nitro-groups already present in the ortho-positions. The methyl groups in trinitro-*o*-xylene would, however, largely account for the difference. Methyl was known to lower the reactivity of chlorine in chlorodinitrobenzene and that of a nitro-group in trinitrobenzene; also the tendency of *m*-dinitrobenzene and *s*-trinitrobenzene to form additive compounds

with amines, the dissociation constant of nitrobenzoic acids, etc. (compare also Blanksma, *Rec. trav. chim.*, 1906, **25**, 175).

Prof. Crossley's proof that 3:4:6-trinitro-*o*-xylene and Meldola's trinitroacetylaminophenol exchanged their nitro-groups in different positions appeared to be of considerable interest. The cause might possibly be traced to the effect which the residual affinity of the hydroxyl group in Meldola's compound must have on the amount of affinity at the disposal of the various benzenoid carbon atoms for binding the nitro-groups.

Dr. R. SELIGMAN asked whether Prof. Crossley had noticed any difference in the mobility of the nitro-groups in 3:4:5-trinitro- and 3:4:6-trinitro-*o*-xylenes. In view of the form which the discussion had taken, several speakers having ascribed the mobility to the ortho-position of two nitro-groups rather than to their para-position, it seemed that any such observation by Prof. Crossley should settle the question, as he had two compounds differing only in the relative positions of the nitro-groups.

In reply, Prof. CROSSLEY stated that at the present time no measurements of value had been made of the relative mobility of the nitro-groups in 3:4:5-trinitro- and 3:4:6-trinitro-*o*-xylenes. Many experimental difficulties would have to be overcome before this would be possible, and work with this object in view was now being undertaken.

***142. "Derivatives of *o*-xylene. Part IV. Synthesis of 4:5-dibromo-3-*o*-xlenol." By Arthur William Crossley and Sydney Smith.**

4:5-Dibromo-3-*o*-xlenol, prepared by the method already indicated (P., 1912, **28**, 333), crystallises from aqueous alcohol in glistening, flattened needles, melting at 97°. The *acetyl* derivative separates from light petroleum in large, hexagonal prisms, melting at 78°, and the *benzoyl* derivative crystallises from alcohol in small, transparent rhombs, melting at 153°.

***143. "The synthetical preparation of the *d*-glucosides of sitosterol, cholesterol, and some fatty alcohols." By Arthur Henry Salway.**

It has already been shown (T., 1913, **103**, 399) that ipuranol and some allied compounds occurring in plants, to which specific names had been assigned, are phytosterol glucosides. In many cases these compounds appear to consist of sitosterol-*d*-glucoside, $C_{27}H_{45}O \cdot C_6H_{11}O_5$, whilst in other instances they seem to be a mixture of the latter with the glucoside of stigmasterol, $C_{30}H_{49}O \cdot C_6H_{11}O_5$.

The author gave a description of the synthetic preparation and properties of some glucosides of the above-mentioned type, and also of the glucosides of some fatty alcohols. The compounds which have now been prepared and characterised are as follows: (1) *Sitosterol-d-glucoside*, $C_{27}H_{45}O \cdot C_6H_{11}O_5$ (m. p. 295—300°); (2) *cholesterol-d-glucoside*, $C_{27}H_{45}O \cdot C_6H_{11}O_5$ (m. p. 285°); (3) *Myricyl-d-glucoside*, $C_{30}H_{61}O \cdot C_6H_{11}O_5$ (m. p. 99°); (4) *ceryl-d-glucoside*, $C_{27}H_{55}O \cdot C_6H_{11}O_5$. This compound was obtained in two modifications, melting at 94° and 135° respectively; and (5) *cetyl-d-glucoside*, $C_{16}H_{33}O \cdot C_6H_{11}O_5$. Although this glucoside was first synthetically prepared by Fischer and Helferich (*Annalen*, 1911, **383**, 68), it has now been somewhat more completely characterised.

Several derivatives of the above-mentioned glucosides have likewise been prepared.

DISCUSSION.

In reply to Dr. Forster, Dr. SALWAY stated that the substances previously designated as ipuranol, trifolianol, cluytianol, etc., were so named in order to indicate their origin and alcoholic nature, and no other method of procedure was possible in the case of new organic compounds of unknown constitution. Since it had now been ascertained that the group of substances referred to were phytosterol glucosides, it was possible to designate them collectively as *phytosterolins*.

***144. "The rotatory dispersive power of organic compounds. Part I. The measurement of rotatory dispersion." By Thomas Martin Lowry.**

A description was given of methods and apparatus suitable for ordinary laboratory use in the measurement of rotatory dispersion. Special importance is attached to measurements of rotatory power for the mercury lines of wave-length 5461 and 4359.

***145. "The rotatory dispersive power of organic compounds. Part II. The form of the rotatory-dispersion curves." By Thomas Martin Lowry and Thomas William Dickson.**

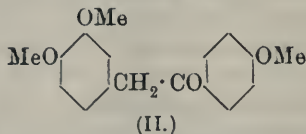
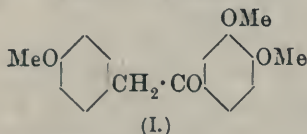
It was shown that the rotatory dispersion in a large number of simple organic compounds can be expressed by the formula:

$$\alpha = \frac{\alpha_0}{\lambda^2 - \lambda_0^2},$$

where α_0 is the "absolute rotatory power" and λ_0^2 is the "dispersion constant" of the substance.

146. "Synthesis of unsymmetrical derivatives of deoxybenzoin."
By John Cannell Cain, John Lionel Simonsen, and Clarence Smith.

The authors have prepared β -keto- α -4-methoxyphenyl- β -3:4-dimethoxyphenylethane (I) by condensing *p*-methoxyphenylacetyl chloride with veratrole, and β -keto- β -4-methoxyphenyl- α -3:4-dimethoxyphenylethane (II) by condensing 3:4-dimethoxyphenylacetyl chloride with anisole. Oximes of both compounds were also prepared.



methoxyphenylethane (II) by condensing 3:4-dimethoxyphenylacetyl chloride with anisole. Oximes of both compounds were also prepared.

147. "A constant pressure viscometer."
By William Hamilton Patterson.

A viscometer was described in which the varying levels of the liquid measured play no part in determining the pressure of flow, and hence no corrections are required for density, etc. Determinations can be carried out at different temperatures. A constant pressure of air drives the liquid slowly through a narrow-bore tube, which is made of fused silica.

148. "The chemical nature of some radioactive disintegration products. Part II." By Alexander Fleck.

In accordance with the theoretical conclusions advanced independently by K. Fajans and F. Soddy since the first part of this paper was published (T., 1913, 103, 381), it has been found that radium-*A* is chemically non-separable from radium-*F'* (polonium), and that thorium-*D* and actinium-*D* are, in the same way, similar to thallium. The non-separability of radium-*A* from polonium was proved by placing two plates of different metals simultaneously in a solution containing radium-*A*, -*B*, -*C*, and -*F'* for one minute. There were thus different potential differences forcing the ions of the radio-elements on to the plates, but it was found that the same relative quantities of polonium and radium-*A* were deposited on each of the various pairs of metals tried.

The case of the similarity of the -*D* members and thallium was shown by a number of reactions and by fractionally precipitating thallium first as chloride and finally as sulphide from an alkaline solution. The concentration of the active substance was not altered in any of the fractions.

Actinium-*B* was also proved to be non-separable from lead by a series of fractional precipitations of lead sulphate, in which it was shown that the concentration of actinium-*B* is constant in all fractions.

149. "The estimation of small quantities of lead."

By Alfred Vincent Elsdon and John Firth Stansfield.

Wilkie's observations (*J. Soc. Chem. Ind.*, 1909, **28**, 636) on the co-precipitation of lead and ferric iron by ammonia have been confirmed, and this property has been applied to the separation and estimation of small quantities of lead. A new method for the estimation of lead in the presence of iron was described, and examples were given.

150. "The iodocinnamic acids."

By Thomas Campbell James.

Three moniodocinnamic acids are at present recorded in the literature, all of which are classed as β -iodocinnamic acids. The author has prepared a fourth isomeride by treating $\alpha\beta$ -dihydroxy- β -phenylpropionic acid (Fittig and Ruer, *Annalen*, 1892, **268**, 27) with a concentrated solution of hydriodic acid at the ordinary temperature.

An examination of the properties of the isomerides indicates that Michael's β -iodocinnamic acids (*Ber.*, 1901, **34**, 3658) are correctly described, whilst that prepared by Ortoleva (*Gazzetta*, 1899, **29**, i, 504) is α -iodocinnamic acid, and the new isomeride is α -iodoallocinnamic acid.

151. "Rate of evolution of gases from supersaturated solutions.

Part I. Influence of colloids and of suspensions of charcoal on the evolution of carbon dioxide." By Alexander Findlay and George King.

The velocity of escape of carbon dioxide from supersaturated solution in water, in solutions of potassium chloride, in colloidal solutions of gelatin, starch, dextrin, ferric hydroxide, peptone, agar, and in aqueous suspensions of platinum and charcoal, has been studied. Measurements were made of the velocity of spontaneous evolution of gas from unagitated solutions, but attention was devoted mainly to the study of evolution from well-agitated solutions, a suitable apparatus and method of working having been devised, whereby the very rapid evolution of gas can be accurately

measured. Whereas, in the case of pure water and solutions of potassium chloride, the velocity of evolution is very nearly proportional to the degree of supersaturation, this no longer holds good in the case of colloidal solutions, which also show marked differences among themselves. In carrying out the measurements, the solutions were first saturated with carbon dioxide under a pressure of about 760 mm. above atmospheric; the pressure was then reduced to that of the atmosphere, and the gas evolved was measured. On reducing the pressure, a period of quiescence, during which practically no gas was evolved, occurred in the case of most of the solutions, but in the case of ferric hydroxide and of peptone no such quiescent period was obtained, and spontaneous evolution of gas took place immediately the pressure was reduced.

152. "Viscosity maxima and their interpretation." By Ferdinand Bernard Thole, Albert George Mussell, and Albert Ernest Dunstan.

In view of the investigations recently published by Denison and by Kurnakov and Schemtschushni on the interpretation of maxima in the viscosity-composition curves of liquid mixtures, the authors have investigated more fully the various types of curves obtained for different liquids, particularly with those pairs of compounds the freezing-point composition curves of which have been determined.

The results show that in general liquids which give a mixture of maximum melting point give also a mixture with a maximum viscosity, although in certain cases a sagged curve may be obtained if one of the components has a higher molecular complexity than the compound formed.

The position of the point of maximum viscosity is not dependent entirely on the composition of the complex, although in cases where the two components have a strong mutual chemical affinity the maximum viscosity is found with the mixture of simple molecular composition, for example, thiocarbimides-amines and sulphuric acid-water.

153. "Condensation of aromatic aldehydes with pyruvic acid." By Eva Lubrzynska and Ida Smedley.

Piperonal, anisaldehyde, and cinnamaldehyde were condensed with pyruvic acid in very dilute alkaline solution; the β -unsaturated α -ketonic acids formed were oxidised with hydrogen peroxide in neutral solution, and the corresponding $\alpha\beta$ -unsaturated acids isolated.

154. "The isolation and purification of cerebrone."

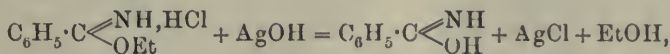
By Arthur Lapworth.

During the last three years the author has frequently had occasion to prepare pure cerebrone from large quantities of brain. He has found it most satisfactory to extract the material, partly dried in spirit, with boiling methyl alcohol, to precipitate most of the phosphatic materials by neutralising the hot liquid with methyl-alcoholic baryta, subsequently decanting the clear, supernatant liquid, and destroying the remaining phosphatides by adding excess of powdered barium oxide and boiling for several hours. The solvent is then mostly removed, and the residue rendered slightly acid with glacial acetic acid in the presence of chloroform, which is subsequently removed by distillation, and the cerebrone, mixed with cholesterol, extracted by methyl alcohol. Complete separation of phosphatides and cholesterol from the cerebrone may be effected in several ways, of which continuous extraction with boiling acetone is the most efficient (compare Lorrain Smith and Mair, *J. Path. Bact.*, 1910, **15**, 122; 1911, **16**, 131; Lapworth, *ibid.*, 1911, **16**, 255; Loening and Thierfelder, *Zeitsch. physiol. Chem.*, 1912, **77**, 202).

155. "Cyaphenine." By John Edwin Mackenzie.

The formula generally assigned to cyaphenine is $(C_6H_5 \cdot CN)_3$, but its molecular weight does not appear hitherto to have been determined directly.

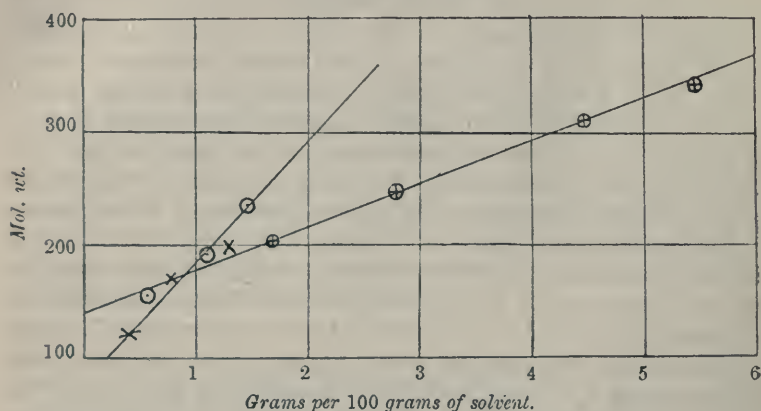
In some experiments performed with the object of obtaining benziminohydrin from benzimino-ethyl ether hydrochloride according to the equation:



cyaphenine was found among the products of the reaction. A number of determinations of the elevation of the boiling point of solutions of cyaphenine [prepared by Eitner and Krafft's method (*Ber.*, 1892, **25**, 2266): it was further purified by distillation under diminished pressure. The product melted at 233° (corr.) in benzene and in carbon tetrachloride showed that in these solutions it possessed no constant molecular weight. The molecular weights obtained in solutions of the concentration stated are plotted on the diagram (p. 176).

The cryoscopic method was found unsuitable on account of the very small solubility of cyaphenine in the solvents available. The

vapour density was then determined, and gave results agreeing with those required for the formula $(C_6H_5 \cdot CN)_3$.



*Molecular-weight Determinations of Cyaphenine by the Ebullioscopic Method.**

$C_{21}H_{15}N_3$ requires M.W. = 309.

Benzene ⊕ Series.

Solvent: 9.8561.

w.	Δ°.	M.W.
0.1451	0.195	203.8
0.2749	0.305	246.8
0.4399	0.390	309.0
0.5377	0.430	342.6

Carbon Tetrachloride ⊙ Series.

Solvent: 20.377 grams.

w.	Δ°.	M.W.
0.1156	0.1754	155.3
0.2221	0.2729	191.7
0.2963	0.2975	234.6

Carbon Tetrachloride × Series.

w.	Δ°.	M.W.
0.0936	0.1688	119.9
0.1746	0.2239	168.6
0.2872	0.3120	199.1

These results have been plotted in the diagram above, and as will be seen, the molecular weight increases steadily with increase of concentration of the solution.

The vapour density was determined by V. Meyer's displacement method, the vaporisation taking place at the boiling point of sulphur:

w.	V. moist air (c.c.).	t.	P (mm.).	M.W.
0.1816	14.0	18°	753	319.0
0.1928	14.7	17°	753	320.5

$C_{21}H_{15}N_3$ requires M.W. = 309.

* The constants for benzene and carbon tetrachloride employed in the calculations were 27 and 48 respectively.

It may therefore be concluded that cyaphenine at a temperature of about 450° has the above formula, but that in chloroform and benzene solutions it undergoes dissociation and association.

156. "Note on the identification of proline."

By Wilhelm Gluud.

Racemic proline is usually identified by its characteristic copper salt, which crystallises from aqueous solution with two molecules of water. In a recent paper Emil Fischer and Gerlach (*Ber.*, 1912, **45**, 2453) showed that the copper salt of pyrrolinecarboxylic acid may be confused with the copper salt of proline, and that a complete analysis is necessary to distinguish between the two.

In the case of allylglycine, which has the same empirical formula as proline, such a method would be of no value. It was therefore desirable to prepare and examine the copper salt of allylglycine, in case it could be mistaken for that of proline.

N-Allylglycine (compare Alpern and Weizmann, *T.*, 1911, **99**, 84) was prepared from chloroacetamide and allylamine as follows: 8 c.c. of allylamine were mixed with 4 grams of chloroacetamide, and the mixture cooled in ice until the reaction had moderated. The liquid was left overnight at room temperature, then diluted with 200 c.c. of water, and 30 grams of recrystallised baryta were added. This mixture was heated on a water-bath for three-quarters of an hour, then boiled for fifteen minutes, and evaporated to dryness in a vacuum. The residue was dissolved in 500 c.c. of water, and the baryta precipitated with carbon dioxide. The filtrate was poured into 20 c.c. of 5*N*-sulphuric acid, and 80 grams of lead oxide (previously purified by boiling with water) were added. The whole mixture was boiled for twenty minutes, then rapidly filtered, and the lead precipitated with hydrogen sulphide. The solution was heated to boiling, then filtered, and the filtrate boiled with precipitated copper oxide for half an hour, rapidly filtered, and the dark blue filtrate concentrated in a vacuum.

The *copper* salt separates in blue crystals shot with violet, in the form of squares or hexagonal plates (2.3 grams), which can be readily recrystallised from water:

0.1165 gave 0.0320 CuO. $\text{Cu} = 21.95$.

0.2093 „ 16.8 c.c. N_2 at 16° and 768 mm. $\text{N} = 9.48$.

$\text{C}_{10}\text{H}_{16}\text{O}_4\text{N}_2\text{Cu}$ requires $\text{Cu} = 21.79$; $\text{N} = 9.61$ per cent.

When dried at $100^{\circ}/10-12$ mm., over phosphoric acid, there is no change in weight or colour of the salt. The copper salt thus prepared is very similar in appearance to that of proline, but it contains no water of crystallisation, so that estimation of water and

copper in a supposed copper salt of proline is sufficient to exclude the presence of allylglycine.

On heating the copper salt of allylglycine, the same odour is noticed as on heating that of proline, but further experiments are necessary to identify the decomposition products.

At the next Ordinary Scientific Meeting to be held on **Thursday, June 5th, 1913, at 8.30 p.m.**, when there will be a ballot for the election of Honorary and Foreign Members, the following papers will be communicated:

"The relationship between the absorption spectra and constitution of piperine, nicotine, cocaine, atropine, hyoscyamine, and hyoscyne." By J. J. Dobbie and J. J. Fox.

"Equivalent conductivities of sodium hyponitrite, calcium hyponitrite, and hyponitrous acid." By P. C. Rây, R. De, and N. Dhar.

"Double carbonates of the alkaline earth metals and lead with potassium carbonate." By R. L. Datta and H. Mukherjea.

"The estimation of nitrites by means of thiocarbamide, and the interaction of nitrous acid and thiocarbamide in the presence of acids of different strength." By M. N. Coade and E. A. Werner.

"A case of isomerism in the methylated ferrocyanides." By E. G. J. Hartley.

"The constituents of hops." By F. B. Power, F. Tutin, and H. Rogerson.

"Anomalous rotatory dispersion. A preliminary note on the form of the dispersion-curve." By T. M. Lowry and T. W. Dickson.

"The nitrogenous constituents of hops." (Preliminary note.) By A. Chaston Chapman.

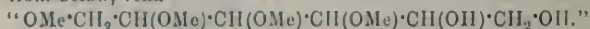
"Absorption spectra and chemical reactivity. Part III. Trinitrobenzene, trinitroanisole, and picric acid." By E. C. C. Baly and F. O. Rice.

"Preparation of secondary amines from carboxylic acids. Part III. Preparation of dissecondary amines from dicarboxylic acids." By H. R. Le Sueur.

ERRATUM.

PROCEEDINGS, 1913.

Page 70, line 17 from below, *read*



PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 29.

No. 417.

Extra Meeting, Thursday, May 22nd, 1913, at 8.30 p.m., Prof. WILLIAM H. PERKIN, LL.D., F.R.S., President, in the Chair.

The Van't Hoff Memorial Lecture was delivered by Prof. JAMES WALKER, D.Sc., F.R.S.

A vote of thanks to Prof. Walker, proposed by Sir William Ramsay, K.C.B., F.R.S., and seconded by Sir William Tilden, F.R.S., was supported by Prof. H. E. Armstrong, F.R.S., and by Prof. F. G. Donnan, F.R.S., and carried with acclamation.

Thursday, June 5th, 1913, at 8.30 p.m., Prof. W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Reference was made to the death, on May 16th, 1913, of Mr. Walter Shelley Spencer, of Farnworth, who was elected a Fellow on June 16th, 1887.

Messrs. P. P. Phillips and A. G. Dix were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:
Parmanand Mewaram Advani, M.A., B.Sc., Dayaram Jethmal
Sind College, Karachi, India.
Alan Hamilton Bateman, 12, Chadwick Road, Leytonstone, N.E.

Norman Phillips Campbell, B.A., Trinity College, Kandy, Ceylon.
 Mohamed Shams Eldin, B.Sc., The University, Manchester.
 Charles Huxtable, Devonian, Menlove Avenue, Liverpool.
 Benedict Hugh Rolfe, M.A., Wheatley, Oxon.
 Philip Howard Stott, Tottington Road, Harwood, Bolton.
 John Algernon Lacy Sutcliffe, 44, Broad Street, Birmingham.

Messrs. H. Rogerson and E. Walker were elected Scrutators, and a ballot for the election of Honorary and Foreign Members was held. The following were subsequently declared duly elected:

Prof. Dmitri Petrovitsch Konovaloff (St. Petersburg).
 Prof. Alfred Werner (Zürich).

Of the following papers, those marked * were read:

- *157. "The relation between the absorption spectra and constitution of piperidine, nicotine, cocaine, atropine, hyoscyamine, and hyoscyne." By James Johnston Dobbie and John Jacob Fox.

The absorption spectra of piperine, nicotine, cocaine, atropine, and hyoscyamine have been examined, and it has been shown that the spectrum in each case is practically identical with that of the unreduced nucleus of the molecule, namely, piperic acid, pyridine, benzoic acid, and tropic acid (compare T., 1911, **99**, 1254; 1912, **101**, 77).

It has also been found that hyoscyne (*l*-scopolamine), although differing in composition from atropine, gives the same spectrum, the difference between the two alkaloids lying only in the unreduced part of the molecule.

- *158. "The constituents of hops."

By Frederick Belding Power, Frank Tutin, and Harold Rogerson.

A consideration of the literature, together with the results of the present investigation, has led the authors to conclude that most of the products hitherto obtained from hops were of a very indefinite nature. A considerable number of well-defined substances, including some new compounds, have now been isolated and completely characterised.

It has been shown that the bitterness of hops is not due to any single substance, but is to be attributed to a number of products, which are mostly amorphous. Some of these products are soluble in water, whilst others represent constituents of the resin. One

well-defined, new, crystalline substance, which possesses a bitter taste, has now been isolated from the resin, and designated *humulol*. This compound is phenolic in character, has the empirical formula $C_{17}H_{18}O_4$, and, when crystallised from 50 per cent. acetic acid, forms needles of a pale fawn colour, which melt at 196° . Another new, crystalline compound, of nearly the same percentage composition as humulol, but which has an orange-yellow colour and is devoid of bitterness, has been designated *xanthohumol*. This substance appears to possess the formula $C_{13}H_{14}O_3$, and melts at 172° .

The present investigation has furthermore shown that the resin of hops contains a large proportion of fatty acids and their esters, a fact which does not seem to have previously been observed or considered. It follows that such of the proposed methods for the valuation of hops as are based on the titration of extracts obtained by means of light petroleum and similar solvents are of very doubtful utility.

DISCUSSION.

Mr. GRANT HOOPER congratulated Dr. Power and his co-workers on the interesting and valuable results of this long over-due investigation. He understood that the volatile essential oil which was removed by steam distillation of the extract upon which the authors worked was disregarded, but he asked whether they could say, nevertheless, if the whole of the odorous character of hops was connected with this volatile essential oil. He realised, of course, that the flavour of hops was of a compound nature, but he would like to know whether the authors were of opinion that the bitter character was exclusively associated with one or all of the resinous substances which had been isolated.

Mr. CHASTON CHAPMAN said that so far as he was aware no one had ever supposed that the separation of the resin constituents into the so-called α -, β -, and γ -resins represented a sharp chemical separation. It did, however, effect a certain degree of separation, and had done very good service from the technical point of view. He also thought that it had been very generally recognised for a considerable time that the bitter flavour of hops was due to a number of substances, and not to any one single constituent. The waxes and certain of the fatty acids were very general constituents of plants, and could not account for any of the characteristic properties of hops. In regard to fatty acids, he was interested in finding that Dr. Power had met with nonoic acid, since some years ago he (Mr. Chapman) had called attention to the fact that this acid existed in the form of an ester in the essential oil, and was obtained by the oxidation of that oil with chromic acid. He suggested that in the hop itself

that acid had probably resulted from the hydrolysis of the ester or from the oxidation of the oil. A number of chemists, who had made a special study of hops, both from the chemical and from the technological points of view, had described certain well-defined crystalline acids which were stated to be closely related to the true resins, and he (Mr. Chapman) did not see which of the constituents mentioned by Dr. Power corresponded with those so-called hop-bitter acids. It was evident that there was still a very great deal to be learned, and in the meantime it would be very interesting to know what light the work of Dr. Power and his colleagues threw on such a very important question as the preservative properties of hops, and how it explained the conversion (by simply boiling with water) of the petroleum-soluble and preservative constituents into products insoluble in petroleum, and possessed of little or no preservative properties. Unless the investigation helped to supply an answer to this and similar questions, its practical value would be considerably diminished. He would like to know from which constituent the valeric acid formed on oxidising the resin was derived.

Dr. POWER, in reply to a question by the President, stated that humulol and xanthohumol contained no nitrogen, and did not combine with acids.

In reply to Mr. Grant Hooper, it was stated that the aroma of hops could only be attributed to the essential oil. It was also explained that as the essential oil obtained in this investigation from an alcoholic extract of hops would naturally differ considerably in composition from a normal oil, as obtained by the direct distillation of hops with steam, it was not deemed desirable to record its characters.

With reference to Mr. Chapman's remarks respecting the character of the substances precipitated from a petroleum extract of the resin by alcohol, it was stated that, in view of the complexity of the extract, a product obtained by such a method would necessarily consist of a mixture of substances.

***159. "The nitrogenous constituents of hops." (Preliminary note.)**
By Alfred Chaston Chapman.

In 1910 the author published (*Proc. Intern. Congress of Brewing*, 1, 93) the results of a preliminary investigation of the nitrogenous constituents of hops, and pointed out that he had commenced a detailed study of the various nitrogenous substances present, that he had already succeeded in obtaining certain crystalline bases, and that the work was being continued. As it has recently come to

his knowledge that Power has been engaged in the investigation of this subject, it appears necessary to give some account of the work so far as it has gone. This work is being continued, and a further communication will be made to the Society in due course.

Owing to the presence in hops of large quantities of resinous materials, the isolation of the crystalline nitrogenous substances, which occur in relatively small proportions, is a matter of very considerable difficulty, and in the course of the investigation four different methods of obtaining these substances have been adopted. In some cases the hops themselves were extracted in the laboratory, but in other cases the extract prepared on the commercial scale was very kindly placed at the author's disposal by the Hop Extract Co., Ltd., to whom his thanks are due. Sometimes the extract represented hops of one particular kind, whilst at other times the extract from hops of mixed growths was intentionally used.

In the first method of working the concentrated aqueous extract of hops was precipitated with basic lead acetate, and the filtrate, after the removal of the excess of lead, was precipitated with phosphotungstic acid. The phosphotungstic precipitate was treated in the usual way, and to the solution containing the liberated bases, ammoniacal silver solution was added for the precipitation of purines. From this precipitate, *histidine* was obtained.

The filtrate from the purines, after having been freed from silver, was evaporated to dryness, and the residue submitted to a process of fractional crystallisation from absolute alcohol, followed by fractional precipitation with mercuric chloride. By these methods betaine and choline were isolated, and another base, which is being examined, was obtained.

From the filtrate from the phosphotungstic precipitate, *asparagine* was isolated, together with another amino-compound, which has not, at present, been identified.

In the second method the hops were mixed with lime, boiled with water, and the resulting mixture evaporated, dried, powdered, and extracted with alcohol. This extract was freed from alcohol, and precipitated with phosphotungstic acid. The solution of the bases thus obtained was precipitated with an ammoniacal solution of silver chloride, and from the resulting precipitate *adenine* and *hypoxanthine* were isolated.

In the filtrate from the purine precipitate, *betaine* and *choline* were again obtained.

In the third method the hops were extracted with ammoniacal amyl alcohol, which was in turn extracted with water acidified with hydrochloric acid. The acid extract was treated with phosphotungstic acid, and from the resulting solution of the bases *adenine*

was again isolated. Betaine and choline were also again obtained.

In this extraction a small amount of a definitely alkaloidal substance was separated, but the quantity was insufficient for complete identification.

With the view of obtaining confirmatory evidence as to the nitrogenous constituents present, a concentrated aqueous extract of hops was treated with a mixture of alcohol and acetic acid, filtered, the filtrate freed from alcohol, and the residue extracted with water. This aqueous extract was then treated systematically with various immiscible solvents. The residue from the amyl alcohol extraction, on treatment with an alcoholic solution of oxalic acid, yielded a precipitate from which *hypoxanthine* was isolated.

From the aqueous extract, which is at present under investigation, a coloured nitrogenous substance was obtained, which is acid in character, and dissolves in alkalis, forming deep brownish-red solutions. The examination of this substance is still in progress. That portion of the hop extract which was not dissolved by the alcohol-acetic acid mixture was repeatedly extracted with water, and the combined aqueous extracts treated with lead acetate and lead oxide. The filtrate, after having been freed from lead, was evaporated, and the residue, after fractionation with alcohol and the removal of the greater part of the potassium by means of tartaric acid, was precipitated by copper acetate with the addition of alcohol. From this precipitate, substances were obtained exhibiting properties which indicate that they are complex amino-acids or polypeptides, or more probably mixtures of these substances, and experiments are now in progress with the object of separating and identifying them.

Although not a nitrogenous compound, it may be mentioned that the insoluble residue from the alcohol-acetic acid extraction, when extracted with hot glacial acetic acid, yielded on cooling a crystalline substance, melting at about 70° , which was almost insoluble in alcohol, and but sparingly so in acetic acid. This substance, which is the "wax" so frequently referred to in the literature of the subject, is being investigated.

From one of the alcohol extracts of the aqueous hop extract, well-formed crystals separated, which on examination proved to be potassium nitrate.

Results have been obtained showing the proportions in which the various groups of nitrogenous compounds are present in hops, and these will be given when the full communication is made. The author is also engaged in an investigation of the technological significance of these nitrogenous constituents, the results of which will be published in due course.

***160. "Anomalous rotatory dispersion." (Preliminary note.)**

By Thomas Martin Lowry and Thomas William Dickson.

By means of a photographic method the rotatory power of ethyl tartrate has been followed up to a point in the far violet region of the spectrum at which the ester produces a lævorotation comparable in magnitude with the maximum of dextrorotation observed with a yellow light. The rotations for 5 points observed photographically and for 13 wave-lengths observed with the eye can be expressed by the formula:

$$\alpha = \frac{k_1}{\lambda^2 - \lambda_1^2} - \frac{k_2}{\lambda^2 - \lambda_2^2}.$$

This confirms the view of Biot that anomalous rotatory dispersion is produced by the admixture of two substances differing in rotatory dispersive power as well as in the sign of their optical rotatory powers. Slow changes of rotatory power with time, comparable with those observed in methyl camphorcarboxylate, were found to take place in the liquid ester.

DISCUSSION.

Dr. Lowry, in reply to a question by Mr. Walker, said that the effect of changing the temperature of ethyl tartrate or of altering the solvent would probably be to alter the magnitude of the two "rotation constants" without altering the corresponding "dispersion constants." It would be quite impossible, however, to detect small changes of dispersive power by analysing a curve which involved four arbitrary constants.

161. "Equivalent conductivities of sodium hyponitrite, calcium hyponitrite, and hyponitrous acid." By Prafulla Chandra Rây, Rajendralal De and Nilratan Dhar.

Equivalent conductivities of sodium hyponitrite, calcium hyponitrite, and hyponitrous acid at various dilutions have been determined at 0°. The ionic mobility of hyponitrosion is 38 (nearly) at 0°. Further, hyponitrous acid is found to be weaker than acetic acid, and stronger than carbonic acid.

162. "Double carbonates of the alkaline earth metals and lead with potassium carbonate." By Rasik Lal Datta and Haridas Mukherjea.

In a paper on the double platinic and cupric iodides (Datta, T., 1913, 103, 426), it has been pointed out that the method of double

decomposition in the presence of an excess of the substituted ammonium iodide was successful in the isolation of the double salts, and it was thought possible that such an indirect method might be useful in the formation of double carbonates which cannot be prepared by direct means. Recently Barre (*Compt. rend.*, 1912, 154, 279) tried to obtain some double carbonates by directly boiling the precipitated carbonates in saturated solutions of the alkali carbonates. In the case of calcium, he succeeded in preparing two salts only, namely, $\text{CaCO}_3 \cdot \text{Na}_2\text{CO}_3 \cdot 2\text{H}_2\text{O}$ and $\text{CaCO}_3 \cdot \text{K}_2\text{CO}_3$, but he failed to obtain double salts with strontium carbonate and barium carbonate even after boiling them for twenty hours in a saturated solution of the alkali carbonates.

The method of preparation of these double salts consists in preparing a saturated solution of potassium carbonate at the room temperature and adding to it the solutions of the metals, preferably the chlorides, when the double salts are at once precipitated. In this case, as in that of the double cupric iodides, the precipitates are unstable in the presence of water, as they dissociate into their constituents, and hence could not be washed freely with water. It is for this reason that a saturated solution of potassium carbonate has been used throughout, and the precipitated salt separated from the mother liquor by strong suction without washing with water.

Barium and strontium carbonates combine with only one molecule of potassium carbonate to form the salts $\text{BaCO}_3 \cdot \text{K}_2\text{CO}_3$ and $\text{SrCO}_3 \cdot \text{K}_2\text{CO}_3$ respectively. Lead carbonate, on the other hand, combines with two molecules of potassium carbonate to form the salt $\text{PbCO}_3 \cdot 2\text{K}_2\text{CO}_3$, and calcium combines with three molecules of potassium carbonate to form the salt $\text{CaCO}_3 \cdot 2\text{K}_2\text{CO}_3$. The abnormality of the composition of double lead and calcium carbonates might be explained in the case of the former as due to its heavy molecular weight, and in that of the latter as due to a special tendency for salt formation, since it forms double carbonates with potassium carbonate even by the direct method.

Potassium Barium Carbonate, $\text{BaCO}_3 \cdot \text{K}_2\text{CO}_3$

(compare Le Chatelier, *Compt. rend.*, 1894, 118, 415).

To a saturated solution of potassium carbonate, a concentrated solution of barium chloride is added, when the double salt is at once precipitated. This is triturated in a mortar with the mother liquor, and filtered with the aid of the pump. The salt could not be washed with water, since it decomposes into its constituents:

0.1802 gave 0.1242 BaSO_4 . $\text{Ba} = 40.55$.

0.7162 „ 0.4906 BaSO_4 and 0.3536 K_2SO_4 . $\text{Ba} = 40.27$;
 $\text{K} = 22.11$.

$\text{BaCO}_3, \text{K}_2\text{CO}_3$ requires $\text{Ba} = 40.89$; $\text{K} = 23.28$ per cent.

Potassium Strontium Carbonate, $\text{SrCO}_3, \text{K}_2\text{CO}_3$.

When a concentrated solution of strontium chloride is added to a saturated solution of potassium carbonate, a transparent, jelly-like mass is obtained, which gradually becomes opaque, and finally, on continued stirring, assumes a granular appearance. After triturating in a mortar, it was collected as usual with strong suction, and allowed to dry in the desiccator. The salt could not be washed by water, since it is decomposed by air:

0.5393 gave 0.3287 SrSO_4 . $\text{Sr} = 29.07$.

0.4365 „ 0.2704 SrSO_4 . $\text{Sr} = 29.55$.

$\text{SrCO}_3, \text{K}_2\text{CO}_3$ requires $\text{Sr} = 30.52$ per cent.

Potassium Calcium Carbonate, $\text{CaCO}_3, 3\text{K}_2\text{CO}_3$ (compare Le Chatelier, loc. cit.; Bütschli, Verb. naturhist.-med. Ver. Heidelberg, [ii], 8, 277).

This is obtained similarly to the above salt, at first as a transparent jelly, which gradually becomes opaque, and is finally transformed into a fine, crystalline powder, which could be collected very easily. The salt was tested for water of crystallisation, which, however, could not be found:

1.0882 gave 0.176 CaO . $\text{Ca} = 7.73$.

0.4726 „ 0.0544 CaO . $\text{Ca} = 7.85$.

$\text{CaCO}_3, 3\text{K}_2\text{CO}_3$ requires $\text{Ca} = 7.77$ per cent.

Potassium Lead Carbonate, $\text{PbCO}_3, 2\text{K}_2\text{CO}_3$.

This is obtained as an amorphous precipitate by adding a concentrated solution of lead acetate to a saturated solution of potassium carbonate. After triturating in a mortar, it was collected by the aid of the pump, when it remained on the filter as a sticky mass, which was allowed to dry in the desiccator. The salt could not be washed for reasons previously assigned:

0.9268 gave 0.5174 PbSO_4 . $\text{Pb} = 38.19$.

0.5462 „ 0.3018 PbSO_4 . $\text{Pb} = 37.73$.

$\text{PbCO}_3, 2\text{K}_2\text{CO}_3$ requires $\text{Pb} = 38.23$ per cent.

The authors are at present engaged in preparing other double carbonates of the series, not only with potassium carbonate, but also with the carbonates of the substituted ammonium bases.

163. "The estimation of nitrites by means of thiocarbamide, and the interaction of nitrous acid and thiocarbamide in presence of acids of different strength." By May Emily Coade and Emil Alphonse Werner.

In continuation of work already published (T., 1912, 101, 2180), experiments have been carried out to test the value of thiocarbamide as a reagent for the estimation of various nitrites. The results have shown that thiocarbamide is a reagent superior to any of those which have been employed hitherto in the estimation of nitrites by the gasometric method.

The advantages of the method are as follows:

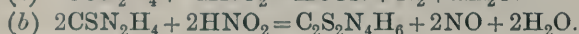
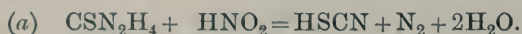
(1) The accuracy of the results are not affected by the presence of nitrates, even when in large excess.

(2) Analyses can be completed in a few minutes; no subsequent manipulation of the evolved gas is necessary as when carbamide is used; the chances of experimental error are thereby reduced.

(3) The gas can be read off with great accuracy; even after a large number of analyses the mercury in the nitrometer remains quite untarnished, which is not the case in other methods.

(4) A much larger number of analyses can be made in a given time than by the other methods; two minutes suffice for the complete evolution of the gas (nitrogen) when acetic acid is used; by the carbamide method, twenty-eight minutes were required to complete the reaction.

In the presence of a weak acid, the change takes place according to equation (a), in the presence of a strong acid according to equation (b):



The total volume of gas evolved is the same in each case for the same weight of nitrite used.

The influence of a number of acids on the direction of the change was examined. It was shown that reactions (a) and (b) proceed simultaneously according to the nature of the acid used, and the direction of the change on the lines of equation (b) was found to be directly proportional to the dissociation constants of the acid.

164. "A case of isomerism in the methylated ferrocyanides."

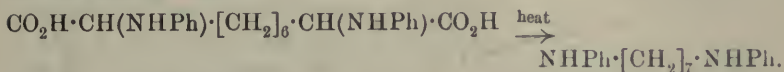
By Ernald George Justinian Hartley.

Further experiments on the preparation of tetramethyl ferrocyanide by heating hexamethylferrocyanogen chloride show that

the former compound is thereby produced in two forms, having the same percentage, composition, and molecular weight, but exhibiting quite distinct properties.

165. "Preparation of secondary amines from carboxylic acid. Part III. Dissecondary amines from dicarboxylic acids." By Henry Rondel Le Sueur.

The α -anilino- and α -1- and α -2-naphthylamino-derivatives of dicarboxylic acids, when heated above their melting points, readily lose two molecules of carbon dioxide, with the formation of the corresponding secondary amines. Thus, a 69 per cent. yield of *s*-diphenyloctamethylenediamine is readily obtained from $\alpha\theta$ -anilino-sebacic acid:

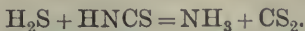


The results obtained show that the method is of general application, and very suitable for the preparation of the alkyl derivatives of aniline and naphthylamine.

166. "Guanidine thiocyanate: its formation from ammonium thiocyanate." By Hans Krall.

Guanidine is produced when ammonium thiocyanate is heated beyond the temperature at which thiocarbamide is formed. The equations usually given to explain the change appear to be purely hypothetical, and no careful experiments seem to have been made with the view of establishing the mechanism of the process.

It was shown that the thiocarbamide first formed partly decomposes into hydrogen sulphide and cyanamide, the latter uniting with unchanged ammonium thiocyanate to form the guanidine salt. The volatile products are hydrogen sulphide, ammonia, carbon disulphide, and the products of interaction of these. The carbon disulphide results from the interaction of hydrogen sulphide and thiocyanic acid:



Since thiocarbamide dissociates into ammonia and thiocyanic acid in its reversion to ammonium thiocyanate (Werner, T., 1912, 101, 2186), the suggestion was made that at higher temperatures it tends to change partly into the isomeric form, $\text{NH}\cdot\text{C}(\text{SH})\cdot\text{NH}_2$, which could dissociate into hydrogen sulphide and cyanamide.

It was found that the best conditions for the preparation of guanidine consisted in heating dry ammonium thiocyanate for four

hours at 200° , when a yield of 60 per cent. was easily obtained. The conditions usually stated, namely, 180 — 190° for twenty hours, are unduly tedious, and have no compensating advantage.

167. "Silicon compounds. Part I. Rational nomenclature of complex silicon compounds and silicates, both organic and inorganic." By Geoffrey Martin.

The author explained a scheme for classifying the compounds of silicon on the basis of the number of linkings between the silicon atoms in the molecule. Compounds in which the silicon atoms are directly united are termed "*silicoses*," whilst those in which the silicon atoms are joined up through oxygen, thus $\text{Si}\cdot\text{O}\cdot\text{Si}$, are termed "*silicates*."

168. "Silicon compounds. Part II. Methylsilicoses derived from silicon hexachloride." By Geoffrey Martin.

The author described compounds derived from the action of magnesium methyl iodide on silicon hexachloride, which contain silicon atoms directly united in a chain, and dissolve in potassium hydroxide evolving hydrogen. They also evolve a mixture of hydrogen and methane when heated.

169. "The synthesis of *o*-aldehydophenylglycine."
By Wilhelm Gluud.

o-Aldehydophenylglycine, which the author considered might prove a suitable source for the production of indole or its derivatives, was synthesised in the following way.

Starting with *o*-nitrobenzaldehyde, by reducing the corresponding oxime with ammonium sulphide, *o*-aminobenzaldoxime was obtained. The latter compound, when heated with chloroacetamide and calcium carbonate, yielded the *oxime* of *o*-aldehydophenylglycinamide, which, on boiling with alkali, gave the *oxime* of *o*-aldehydophenylglycine. The oxime group was removed by dilute sulphuric acid, yielding *o*-aldehydophenylglycine, $\text{CHO}\cdot\text{C}_6\text{H}_4\cdot\text{NH}\cdot\text{CH}_2\cdot\text{CO}_2\text{H}$. The pure dry compound consisted of aggregates of colourless crystals, melting at 176 — 177° .

When heated with lime, either the aldehyde or the oxime of *o*-aldehydophenylglycinamide yielded indole or its derivatives; this reaction will be further investigated.

A crystalline compound, supposed to be *o*-cyanophenylglycine,

was prepared from the oxime of *o*-aldehydophenylglycinamide and sulphuric acid.

By the fusion of the oxime of *o*-aldehydophenylglycine or the corresponding amide with potassium hydroxide, phenylglycine-*o*-carboxylic acid and indigotin were produced in quantities depending on the experimental conditions.

170. "Colour and constitution of azomethine compounds. Part III."

By Frank George Pope and Winifred Isabel Willett

Unsuccessful attempts have been made to obtain azomethine compounds from *p*-nitroaminoazobenzene. Various derivatives of aminoazobenzene were described, together with some compounds related to *p*-nitroaminoazobenzene. *p*-Nitrobenzeneazobenzeneazophenol has been prepared, and the absorption spectra of the azomethines derived from aminoazobenzene, together with those of *p*-nitrobenzeneazophenol and *p*-nitrobenzeneazobenzeneazophenol, have been observed.

171. "Note on cupric malate and citrate."

By Spencer Umfreville Pickering.

When alcohol is added to a solution of copper carbonate in glyceric, malic, or citric acid, it precipitates an emulsion, which dries to a pale blue solid, very soluble in water, forming a dark blue solution, in which the copper, on electrolysis, is found to be in the electronegative ion. The compound present is a cupri-compound metameric with the normal cupric salt, which latter, in the case of the glycerate, crystallises gradually from the solution, and is sparingly soluble. Normal cupric malate has now been obtained in the same way, and is insoluble, but the presence of some excess of acid is necessary to prevent the formation of a basic salt. The normal citrate has not been obtained; a concentrated solution of the cupricitrate solidifies in ten minutes to a mass of blue, moderately soluble crystals of (probably) a basic cupri-compound, $(R'''_2Cu_3)_2 \cdot CuO$, which, after thirty minutes, changes to an insoluble, amorphous, ordinary basic salt of the same empirical formula.

172. "Organic ferric salts."

By Spencer Umfreville Pickering.

The quadrivalent character of copper in the cupri-compounds is supported by the similarity between these and the salts of quadrivalent iron. In the latter the iron is electronegative, does not

react as iron with ordinary reagents, and has a colour intensity about twenty times greater than that of iron in inorganic ferric salts. They are very soluble, and alcohol precipitates emulsions from them. Evidence as to the definiteness of their composition was given. In the case of the tartrate, malate, and citrate, the corresponding normal salts have not been obtained, but they each yield a highly soluble basic ferri-compound, R''_3Fe_2, Fe_2O_3 , and an insoluble, ordinary basic salt of the same formula, thus resembling the cupricitrate. Ferric oxalate is a normal salt, and the acetate appears to be dissociated in solution into acetic acid and colloidal ferric hydroxide. Attempts to prepare alkaline ferri-compounds have failed.

173. "The colour intensity of iron."

By Spencer Umfreville Pickering.

The molecular colour intensity of iron in solutions of ferric chloride, nitrate, and sulphate is practically identical (taken as unity), and is nearly constant throughout a considerable range of strength. It gradually rises to 2.5, after which further dilution causes it to fall; but these dilute solutions are not stable, and darken gradually, ultimately exhibiting a colour intensity of 140, which is that of iron in colloidal ferric hydroxide. This first rise to 2.5 is not due to the presence of colloidal iron, but to iron in some other highly coloured form, probably that in which it exists in organic ferric salts, where it is electronegative, and has a colour intensity of 24. This value is nearly realised in the case of the sulphate. As excess of acid in the case of the sulphate and nitrate render these salts colourless, it is probable that the true colour intensity of electropositive iron is nil, the yellow colour of the neutral salts being due to the presence of some of the compounds with the iron electronegative.

174. "The conversion of α -amino-acids into α -ketonic aldehydes, and their relation to α -hydroxy-acids." By Henry Drysdale Dakin and Harold Ward Dudley.

The authors have recently shown (this vol., p. 156) that α -hydroxy-acids, in aqueous solution, yield α -ketonic aldehydes. Lactic acid, for example, gave methylglyoxal. It is now found that α -amino-acids behave similarly. Thus alanine, on digestion at low temperatures in faintly acid solution, with *p*-nitrophenylhydrazine may yield methylglyoxaldinitrophenylhydrazone. Other amino-acids, such as glycine, leucine, aspartic acid, phenylalanine, behave similarly. The yields are relatively small:



The formation of α -ketonic aldehydes from α -amino-acids has interesting biological relations. It indicates, for example, a possible mechanism for the interconversion of alanine, lactic acid, and dextrose in the living cell, since each of these substances has been shown to be convertible into methylglyoxal, which in turn has been found by the authors to yield dextrose in the diabetic organism.

175. "The mode of combustion of carbon: the effect of drying the oxygen." By Thomas Fred Eric Rhead and Richard Vernon Wheeler.

It was shown that the results of experiments with well-dried oxygen do not conflict with the supposition that, in the burning of carbon, a "physico-chemical complex" is first formed; and that any carbon monoxide and carbon dioxide that may appear to be the primary products of combustion arise from decomposition of this complex.

It would seem that decomposition of the complex is accelerated by the presence of moisture.

176. "Cantharene, and other hydrocarbons allied to the terpenes." By Walter Norman Haworth.

An account was given of the synthesis of hydrocarbons of the dihydroxylene series, one of these being 1:2-dimethyl- $\Delta^{2:6}$ -cyclohexadiene, $\text{CMe} \begin{smallmatrix} \text{CMe} \cdot \text{CH} \\ \text{CH} \cdot \text{CH}_2 \end{smallmatrix} > \text{CH}_2$, the properties of which agree with those described by Piccard for the substance, cantharene, obtained from cantharidine by distillation with lime (*Ber.*, 1878, 11, 2122). The physical constants of this $\Delta^{1:5}$ -dihydro-*o*-xylene, and of a corresponding meta-derivative, were compared with the data recorded by Auwers for $\Delta^{1:3}$ -dihydro-*p*-xylene, the gradation in the spectrochemical properties of the three hydrocarbons being analogous to that found for the three xylenes.

A lower homologue of the terpenes, C_9H_{14} , has also been synthesised, and its physical constants measured. This substance is 1-methyl-2-isopropenyl- Δ^1 -cyclopentene, $\begin{smallmatrix} \text{CH}_2 \cdot \text{CMe} \\ \text{CH}_2 \cdot \text{CH}_2 \end{smallmatrix} > \text{C} \cdot \text{CMe} \cdot \text{CH}_2$, and

it differs in constitution from the terpenes only in respect of its containing a ring of five carbon atoms in place of the cyclohexene structure of dipentene. The above hydrocarbon is the fourth member of the group of terpenes derived from cyclopentane, three others having been already described by Haworth and Perkin (*T.*, 1908, 93, 573).

177. "The molecular condition of mixed liquids. Part I. Mixtures of the lower aliphatic alcohols with water." By William Ringrose Gelston Atkins and Thomas Arthur Wallace.

From a study of the cryoscopic behaviour of mixtures of alcohols and water in aniline, no decided evidence could be obtained of any combination to form hydrates, even in the case of trimethylcarbinol, where the freezing-point concentration diagram shows the existence of a hydrate.

Mixtures of the alcohols and water in equimolecular proportions show a decrease in the contraction on mixing, when the alcohols are arranged in the same order as are their association factors, determined by Ramsay and Shields. Rise of temperature results in a decrease of the contraction on mixing in all cases except that of methyl alcohol, where, up to 43° at any rate, there is an increase of contraction. An explanation of this behaviour is offered in terms of the formation of hydrates. Calculation of the molecular volumes of these mixtures at various temperatures by means of Traube's constants points to the formation of hydrates containing equimolecular proportions of alcohol and water. These problems are being studied further.

178. "The purification of acetone by means of sodium iodide." By Kathleen Shipsey and Emil Alphonse Werner.

It was recently shown (this vol., p. 117) that sodium iodide can unite with acetone to form a crystalline compound having the composition $\text{NaI} \cdot 3\text{C}_3\text{H}_6\text{O}$. Experiments have now been made which show that acetone in a high degree of purity can be prepared from the commercial article in a very simple manner by the aid of sodium iodide. The hydrated salt $\text{NaI} \cdot 2\text{H}_2\text{O}$ may be used with advantage on account of its ready solubility in acetone; the solution when cooled to about -8° gives a very good yield of the above compound, and it is possible to obtain 70 per cent. of the acetone in a pure state in a single operation. The purified acetone was found to be quite equal to that prepared by the rather tedious bisulphite process.

179. "The absorption spectra of some thio-derivatives of benzene." By John Jacob Fox and Frank George Pope.

The absorption spectra of phenyl mercaptan and diphenyl sulphide were compared with those of phenol and diphenyl ether; and it was found that the substitution of sulphur for oxygen had resulted in an entire change in the character of both the vapour

and solution spectra. The characteristic bands of the benzene spectrum were suppressed by the introduction of the thiol group into the molecule.

The spectrum of phenol vapour contained a large number of sharp, narrow bands which were absent from the spectrum of phenyl mercaptan. It was found that the position of the bands in the spectra of the solutions corresponded with certain groups of bands in the vapour state; and the extensions of the solution spectrum of diphenyl sulphide were definitely associated with the absorption bands in the spectrum of the vapour of this substance.

180. "The nickel salts of the benzildioximes."

By Frederick William Attack.

It has been shown by Tschugaev that α -(*syn*)dioximes form nickel compounds, in which only one of the oxime groups has its hydrogen atom replaced by metal, but he has repeatedly stated that both β -(*anti*-) and γ -(*amphi*-)dioximes do not yield nickel salts. It is now shown that γ -benzildioxime forms a definite and stable nickel compound in which both oxime groups are involved, giving a cyclic structure containing nickel. Tschugaev's statement that only α -dioximes are capable of forming nickel compounds is therefore untenable. All attempts to prepare a nickel compound of the β -modification have failed, nickel hydroxide being obtained in every case. It would appear probable from the results obtained that, of the oxime groups contained in 1:2-dioximes, in the α -(*syn*-)modification, one group is basic, the other acidic; in the β -(*anti*-)modification, both groups are basic; and in the γ -(*amphi*-)modification both groups are acidic.

181. "Preparation of secondary and tertiary acid amides from their metallic derivatives." By Jitendra Nath Rakshit.

When primary acid amides are heated with metallic sodium in indifferent solvents, they undergo condensation to secondary amides, which are isolated as sodium derivatives. Potassium under similar conditions gives, with formamide, potassium diformamide, but with acetamide and propionamide it yields only simple potassium substitution derivatives. From sodium diacetamide, di- and tri-acetamide are prepared by the action of hydrochloric acid and acetyl chloride respectively.

182. "The addition of negative radicles to Schiff's bases."

By Thomas Campbell James and Clifford William Judd.

The authors have investigated the formation and decompositions of a large number of the additive compounds formed from Schiff's bases with chlorine, bromine, iodine, and acyl haloids. In every case investigated, chlorine and bromine form dihalogen additive compounds, which are only sparingly soluble in non-ionising media, but dissolve readily (with partial decomposition) in alcohol, acetone, or ether. On treatment with water, acids, or alkalis, they undergo decomposition in two ways, (a) as indicated by Hantzsch (*Ber.*, 1890, **23**, 2773) in the equation:

$\text{CHPh:NPh,Br}_2 + \text{H}_2\text{O} = \text{Ph}\cdot\text{CHO} + \text{C}_6\text{H}_4\text{Br}\cdot\text{NH}_2(1:4) + \text{HBr}$,
and (b) with elimination of halogen and production of the decomposition products of the Schiff's base. Alkalis favour the former, acids the latter decomposition.

The additive compounds with acyl haloids are of similar type, and are decomposed by warming with acids into aldehyde and acylamine.

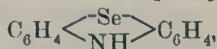
With Schiff's bases iodine forms periodides, which, on heating gently, form red di-iodides.

The compounds may probably be formulated as quinquevalent nitrogen derivatives, although the possibility of a quinonoid structure is not entirely eliminated.

183. "The preparation of some organo-selenium compounds."

(Preliminary note.) By Charles Weizmann and Henry Stephen.

The authors have prepared *selenodiphenylamine*,

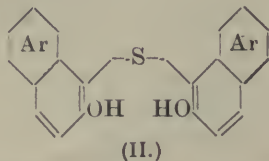
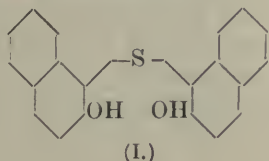


which is obtained according to the two following methods: (a) by boiling a mixture of diphenylamine and selenium in a metal-bath for thirty hours until the evolution of hydrogen selenide ceased; (b) by heating a mixture of the theoretical quantities of diphenylamine and selenium monochloride.

In both cases the product is separated from diphenylamine by distilling it under diminished pressure, and crystallising the crude substance from ethyl alcohol. Selenodiphenylamine crystallises from ethyl alcohol in pale yellow plates, which melt and decompose at 189° . The crystals on exposure to air gradually darken to a green tinge, and in solution with concentrated sulphuric acid a violet coloration is produced. The research is being continued.

184. " β -Naphthol sulphide and *iso*- β -naphthol sulphide; and the constitution of β -naphthol." By Thomas Joseph Nolan and Samuel Smiles.

The results of previous experiments were used in discussing the constitution of the two sulphides. It was concluded that the normal sulphide is the true α -sulphide of β -naphthol (I), whilst the *isosulphide*, which is formed by reducing naphthasulphonium-quinone, is represented as in II, and may be regarded as the hydro-sulphonium-quinone:



The constitution of β -naphthol was also discussed, and it was concluded that in this substance, and probably also in naphthalene, the hydrocarbon nucleus exists in a symmetrical condition.

185. "The nitrites of thallium, lithium, cæsium, and rubidium."

By Walter Craven Ball and Harold Helling Abram.

Thallous nitrite, TlNO_2 , is a bright, orange-red, soluble, crystalline salt.

Hydrated lithium nitrite crystallises with one molecule of water, as stated by Rây (P., 1908, **24**, 75).

Cæsium nitrite, previously examined by Jamieson (*Amer. Chem. J.*, 1907, **38**, 616), closely resembles the potassium salt, as also does rubidium nitrite.

186. "Note on the fat of the seeds of '*Oncoba echinata*'; occurrence of chaulmoogric acid." By Ernest Goulding and Noel Charles Akers.

Samples of the seeds of the "Gorli" plant (*Oncoba echinata*, Oliver) have been received at the Imperial Institute from Sierra Leone, and have been examined with the following results.

The seeds contained 5.8 per cent. of moisture, and, on extraction with light petroleum, yielded about 47 per cent. of a hard, opaque, white fat of a crystalline appearance, and possessing a peculiar, characteristic odour. The fat furnished the following constants: $D_{15.5}^{100}$ 0.898, $[\alpha]_D^{17}$ +48.8°; acid value, 4.5; saponification value, 192.4; iodine value, 99.7; Hehner value, 96.5; Reichert-Meißl

value, nil; unsaponifiable matter, 1.5 per cent. It had no definite melting point, but gradually liquefied above 35°, and was completely melted at 45°.

The fatty acids obtained by hydrolysing the fat had an iodine value of 105.1, $[\alpha]_D^{18} + 52.5^\circ$, and consisted of a mixture of a crystalline solid and a liquid. By pressing the mixture between folds of filter-paper, a large proportion of the solid substance could be separated, and on recrystallisation from warm alcohol it was obtained in thin, lustrous plates, melting at 69°. This acid gave an iodine value of 90.5, and $[\alpha]_D^{17} + 60.0^\circ$; it was identified as chaulmoogric acid, $C_{17}H_{31}\cdot CO_2H$ (Power and Gornall, T., 1904, 85, 846), by the analysis of the silver salt and the preparation of the methyl ester, which melted at 22°, and had $[\alpha]_D^{21} + 55.8^\circ$.

The liquid portion of the fatty acids, although saturated with chaulmoogric acid, gave an iodine value of 122, showing that the liquid acids are highly unsaturated; it darkened rapidly on exposure to the air.

The investigation showed that the fatty acids consisted approximately of chaulmoogric acid, 87.5 per cent., and liquid acids, 12.5 per cent.

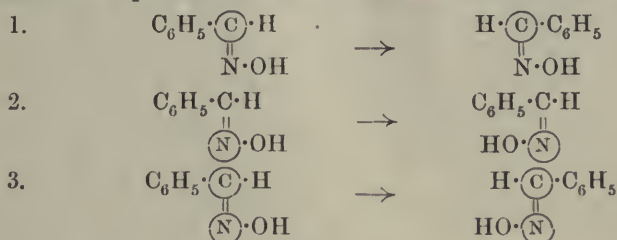
187. "A new model to illustrate the Walden inversion."

By William Edward Garner.

This model consists of a wooden ball, divided vertically into three equal sections, which are bolted together so as to leave a space between each. Additional stability is conferred on the structure by rings situated at the top and the bottom of the model. To each of the bolts, which are placed as near the centre of the model as possible, is attached a steel arm, capable of being vibrated with an upward and downward motion. The three arms are connected by thin cord to the middle of a central glass or metal rod DD' , which passes through the two rings. The method of attachment is seen by reference to the diagram (Fig. 2). By the movement of the central rod upwards through the rings, the three arms are caused to move simultaneously, and if this movement is made sufficiently great, they pass downwards into the enantiomorphous position.

The Werner model, constructed by the author (P., 1912, 28, 65), was utilised to illustrate the change of maleic acid into fumaric acid, without the destruction of the double bond, and its employment in this connexion naturally suggested its use in the transformation of *syn*- into *anti*-oximes. In the latter case the inter-conversion of the isomeride may be demonstrated in either of two

ways, namely, (1) by the inversion of the valencies of the carbon atom, and (2) by the inversion of those of the nitrogen atom. If both the carbon and nitrogen atoms undergo inversion, no change in the oxime is produced. The three cases are illustrated below:



The first method was easily carried out by means of the previously described model (*loc. cit.*), but in order to illustrate the

FIG. 1.

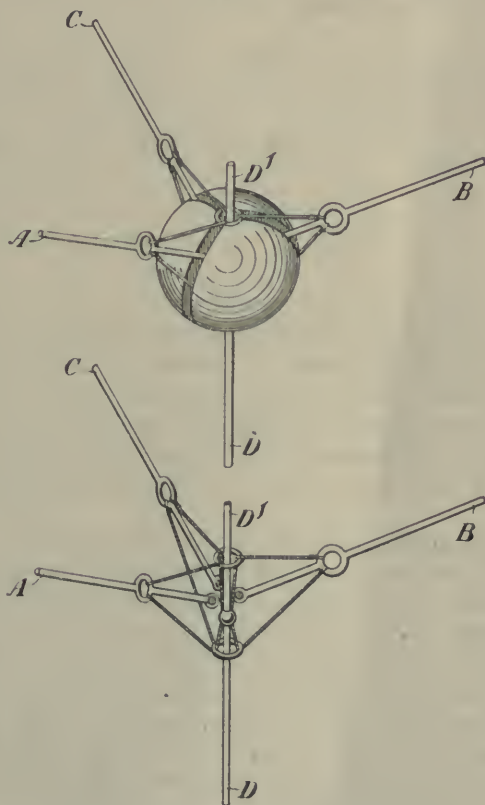
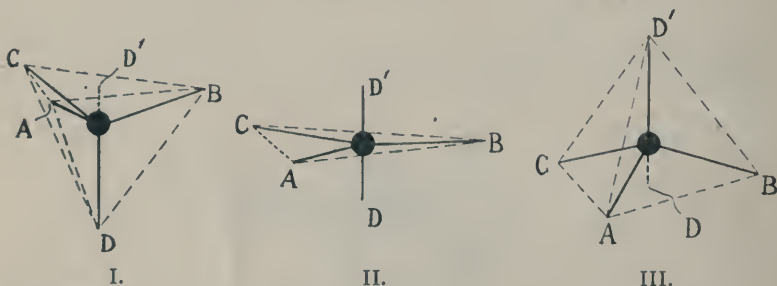


FIG. 2.

second case, it was necessary to devise a tervalent nitrogen model, the valencies of which could readily be inverted. The new model was constructed for this purpose.* The central rod is then made of glass, and the valency arms, *A*, *B*, and *C*, represent the nitrogen tetrahedron of Hantzsch and Werner. Two of the valencies of this model are connected by thin rubber tubing to two arms of a carbon model, and the transformation effected, as has been previously described in the case of maleic and fumaric acids (*loc. cit.*).

The appearance of the nitrogen model, when completed, suggested to the author that it might be applied to represent some of the properties of the asymmetric carbon atom; the ends *A*, *B*, and *C* of the three arms, together with the end of the rod *D*, form the vertices of a tetrahedron, and consequently may represent the four groups attached to a carbon atom. The ease with which this tetrahedron is inverted renders the model suitable for the illustra-



tion of racemisation and Walden inversion phenomena. Gadamer (*Chem. Zeit.*, 1910, **34**, 1004) had previously put forward the idea which it embodies, and had developed it fully to furnish an explanation of racemisation, and later has extended his theory to account for the differences in the behaviour of silver oxide and other bases on optically active chloro-acids (Frankland, T., 1913, **103**, 722).

If the model represent a chemical molecule the group *D* may be replaced by another group with a change of configuration. In order to accomplish this, according to the Werner theory (*Ber.*, 1911, **44**, 881), the entering group must approach the molecule *A*, *B*, *C*, *D* from the side opposite to that occupied by the group *D*, and attach itself by means of its partial valencies at *D'*; if it is attracted to any of the other faces, no inversion would be obtained. Simultaneously with this addition, the group at *D* is gradually removed, and a corresponding movement of the other valencies

* A model was first constructed in April, 1912.

occurs in a downward direction. The molecule will pass through an intermediate position II, in which the three valencies *A*, *B*, and *C* lie in one plane, and the fourth valency is divided into two halves at *D* and *D'*, and in this position the entering and extruded groups are attached to the carbon atom with equal force. In other intermediate positions the length of the central valency above and below the ball will indicate the relative strength of the attachment of the two groups. Finally, the groups pass into the enantiomorphous position III, in which the group, originally attached at *D*, is completely removed.

Coloured balls or paper may be attached to the arms to represent the various groups.

188. "The Baly-Krulla theory of fluorescence. A reply to A. W. Macbeth." By Edward Charles Cyril Baly.

In a recent paper (P., 1912, **28**, 271) A. W. Macbeth criticised the theory of fluorescence which Dr. Krulla and the author advanced (T., 1912, **101**, 1469). It seems that this criticism is based upon a misconception of the theory itself and of the processes which take place.

According to the theory the condensed force fields surrounding the molecules of a substance may be opened up in stages by the influence of a solvent and of light. These stages may be called 1, 2, 3, 4, etc., and each one absorbs light of different wave-lengths, λ_2 , λ_3 , λ_4 , etc. Whereas previously only two of these stages had been recognised, the existence of several definite stages in the opening up of the condensed field of force has now been proved, and it is hoped very shortly to communicate the results of certain observations, which clearly show how by the use of suitable solvents several different stages can be produced absorbing different wave-lengths of light.

Now it is obvious that in the absorption of these light waves considerable damping must be present. If this were not so it is evident that the whole substance would on prolonged exposure become diactinic. This is, however, absurd; owing to the damping that is present the light actually does work against the chemical forces, and is therefore changed, probably into heat, so that as the result a continuous and constant absorption of the light takes place. It would seem that Macbeth has not taken this damping into consideration. He states that if the substance can exist in stages 1, 2, 3, etc., these forms must be in equilibrium with one another. This is not a correct assumption. If the stage 3 were present in

equilibrium with 1 and 2, and if, according to hypothesis, $1 \rightarrow 3$ or $2 \rightarrow 3$ can be produced by absorption of light λ_3 , it is absolutely certain that λ_3 would be absorbed out of a light source containing these waves. It is an experimental fact that λ_3 is not selectively absorbed as long as the solvent necessary is absent. In other words, if a fluorescent material which absorbs λ_2 and emits λ_3 is screened from λ_2 no trace of selective absorption of λ_3 can be detected. This rules out of court the assumption that stage 3 is normally present in simple equilibrium with 1 and 2.

Under the influence of the light a photodynamic equilibrium is set up, which is a very different thing from the chemical equilibrium assumed by Macbeth.

Macbeth's first criticism therefore seems absolutely to fail, first, because he assumes that stages 1, 2, 3 are in simple equilibrium; secondly, because he neglected the damping; and thirdly, because he assumes that the substance when screened from λ_2 must absorb λ_3 .

Macbeth states further that the theory, although it cannot explain fluorescence, is more capable of explaining phosphorescence. It is now generally agreed that the two phenomena are really the same, and only differ in the relative velocity of the two processes, absorption and emission. In any case of fluorescence or phosphorescence there are two processes: the absorption of energy, and the emission of energy. If the velocity of the second process is equal to or greater than that of the first, then the substance fluoresces, but if the velocity of the emission is slower than that of the first, then phosphorescence takes place, namely, the persistence of the emission for an appreciable time after the exciting cause has been removed. In certain cases the velocity of the emission of the energy is exceedingly small, and in these circumstances the energy absorbed in the first process remains stored up in the substance for a very long time unless the velocity of the emission is increased by some means, such as the application of heat, when the phenomenon is known as thermoluminescence. There seems, indeed, no reason to assume any difference between the two phenomena, and if a theory can explain one of them, it follows that it can explain the other.

According to the theory, the stages 1, 2, 3, . . . n , inasmuch as they are stages in the opening up of the condensed system of a single molecule, are intimately connected with one another, and although the process by which λ_2 is absorbed in the solvent is the only one which light itself is capable of bringing about, yet there can hardly be any objection to the probability that the disturbance to the whole system produced in this way will bring the next

possible vibration periods into play, namely, stage 3 followed in less degree by stage 4, and so on.

It is known that, given the necessary external conditions, stages 3, 4, etc., are characterised by vibrations synchronous with wave-lengths λ_3 , λ_4 , etc.; if these vibrations are brought into play by means of some other vibration they will emit light of the same wave-length.

Macbeth seems to have fallen into an error as regards the relationship between the wave-length of the exciting light and the emitted light. In producing phosphorescence of wave-length λ_3 , λ_3 is not absorbed.

There does not seem to be any difficulty in reconciling all observations as regards the relations between temperature and phosphorescence. In the first place, the conditions may occur when the process $2 \rightarrow 1$ is very slow indeed, with the result that the process $1 \rightarrow 2$ will take place with absorption of λ_2 . After some time the whole system will have absorbed considerable energy. On heating the system, or in many cases simply by rubbing or shaking, conditions are produced that enable the process $2 \rightarrow 1$ to take place, with the result that a considerable amount of free energy escapes as heat, and the whole system gets disturbed, and some of the vibrations of stage 3 are called into play with emission of λ_3 . In this process no λ_2 is emitted. Care must be taken not to look upon processes $1 \rightarrow 2$, $2 \rightarrow 3$, or $1 \rightarrow 3$ as being directly reversible, absorbing or emitting the same amount of light energy, for if this were so, it would simply resolve itself into a case of resonance phenomena. Macbeth has fallen into error here when he says that the reverse process $2 \rightarrow 1$ will be accompanied by the emission of light λ_2 , as demanded by Kirchhoff's law. Kirchhoff's law has nothing whatever to do with the case, for it is not a case of black body radiation. The reverse process $2 \rightarrow 1$ is not accompanied by emission of λ_2 , but probably by emission of heat, and the process is not reversible.

The next point is: why do some substances fluoresce only at low temperatures when the free energy is less than before? The lowering of temperature will tend to produce a more completely closed system of force lines round the molecule. There must naturally exist a particular condition of this condensing together of the force lines for the particular type of fluorescence observed to take place, and it follows directly from the theory that this condition may be produced at low temperatures when it does not exist at higher temperatures.

It has been shown (T., 1913, 103, 91) that when a substance is opened up by a solvent and by light, the amount of light absorbed

increases with the dilution up to a maximum, after which further dilution tends to decrease the amount absorbed, which is then followed by the disappearance of the selective absorption. There is thus an optimum condition of concentration as far as absorption of light is concerned. This agrees with and explains Lenard and Klatt's and Urbain's observations on phosphorescence, for these authors have clearly shown that there is always a definite condition of concentration of phosphorescence in the diluent at which an optimum of phosphorescence is observed. Clearly at this concentration the phosphorogen has its closed force field just sufficiently opened up, and in that condition best adapted to respond to the exciting vibrations in such a way that the next stages, 3, 4, 5, etc., are called into play. This optimum condition only refers to one particular temperature. At a much lower temperature that condition will not necessarily give the optimum, and indeed, perhaps, may not give any phosphorescence at all. Some other concentration will be more suited for the new temperature conditions, and whilst this new concentration may not suit the old temperature, yet on cooling, the phosphorescence or fluorescence makes its appearance.

A specific example may make this clearer, namely, the phosphorescence of strontium sulphide. Becquerel (*Ann. Chim. Phys.*, 1859, [iii], 55, 5) found that this material gives at 200° an orange phosphorescence, and as the temperature falls the colour passes through yellow, green, and blue until at -20° it is dark violet. This observation has been confirmed for a great number of substances by Lenard and Klatt (*Ann. Physik*, 1904, [iv], 15, 225, 425, 633). The reason of this effect is that the phosphorescent spectrum consists of at least five separate maxima having the above colours, and as the temperature is changed the relative intensity of the various maxima alters, and in the case of the strontium sulphide the tendency, with decrease of temperature, is for the maximum of the phosphorescence to move towards the shorter wave-lengths. If the separate bands in the phosphorescent spectrum be called *A*, *B*, *C*, *D*, *E*, then at the higher temperatures *A* will be the most intense, and as the temperature falls, *B*, *C*, *D*, *E*, in turn, show the greatest intensity. Each of these corresponds with a definite stage in the opening-up process, and the optimum condition for each stage, provided that the quantity of diluent remains the same, depends on the temperature. By varying the conditions of diluent, similar variations in the relations between the intensities of the different phosphorescent maxima can also be obtained under constant temperature conditions.

This fact has an important bearing on the general theory. Since the whole phenomenon of phosphorescence is a property of diluted

matter, and since the fall of temperature allows more and more free energy to escape from the system, it follows that the lower the temperature the less is the phosphorogen opened up by the diluent. The observations on phosphorescence therefore run *pari passu* with the observations on absorption, for here the more a compound is opened up by a solvent the nearer the absorption maximum lies to the read. In other words, the more complex the solvent-solute system, or, speaking generally, the more complex the system of the force field dealt with, the nearer to the red will be its absorption and also its phosphorescent or fluorescent maximum. Macbeth in his criticism, based on the fact that some substances do not phosphoresce or fluoresce at ordinary temperatures and do so at low temperatures, has really advanced observations which strengthen and confirm the theory.

Again, Macbeth attempts to draw an analogy between a spring in various stages of compression and the stages 1, 2, 3, etc. This analogy fails absolutely from the start, because it requires the same energy in different amounts to obtain the spring in the different stages of compression, while in the real case the stages 2 and 3, etc., require for their actual production not only a different solvent, but light of different wave-length. He also contradicts himself here, because in order for the analogy to be complete from his point of view, the states of the spring when in different stages of compression must be in equilibrium with one another, an assumption he made for the stages 1, 2, 3, etc.

Two further criticisms of Macbeth still remain to be dealt with. First, Nichols and Merritt's observations that the position of maximum fluorescence is independent of the wave-length of the exciting light, and that the latter may be on the red side of the fluorescent maximum. Macbeth says the processes are now reversed, and λ_3 is being absorbed and λ_2 emitted. This is by no means the case. An inspection of the absorption and fluorescent curves shows that these extend considerably on each side of the maximum in each case. They frequently, indeed, overlap, and therefore the very fact of Nichols and Merritt's discovery strongly supports the theory. The shape of the fluorescent curve is characteristic of the substance under the conditions of solvent and concentration. This fluorescence will be produced by any wave-length included in the absorption band, even if it happens by chance to be longer than those emitted. The substance responds to and absorbs the longer wave-length, and it is natural to expect that it would produce the same effect as any other wave-length in the same absorption band. Nichols and Merritt also observed in the same paper (*Physical Review*, 1904, **19**, 18) that if the

fluorescent substance has a second absorption band of longer wave-length than the fluorescent light, the absorption of light in this second region does not produce fluorescence, which fact, of course, is in agreement with this theory.

Finally, Macbeth quotes the observation of R. W. Wood, who showed that while fluorescing with light of definite wave-length a substance exerts no increased absorption of that light. On a theory of optical resonance "fluorescence absorption" might be expected, and the fact that it has been proved absent argues strongly against any simple resonance as a basis of fluorescence and absorption. Nothing whatever in the theory makes it probable that fluorescence absorption should take place. A criticism based on the fact that it does not take place seems therefore somewhat irrelevant.

The general conception may be made clearer by considering it in the following way. Light energy (λ_2) is absorbed and converted partly into heat and partly into light energy (λ_3). In ordinary circumstances this reaction is not reversible, because λ_3 is not absorbed, but it might be considered that under certain special labile conditions it does become reversible. The absorption of λ_3 during fluorescence would mean that the same reaction was taking place in opposite directions at the same time and absorbing energy on both counts. Whether the process is reversible or non-reversible, there is no reason why λ_3 should be absorbed during fluorescence.

ADDITIONS TO THE LIBRARY.

I. Donations.

Cain, *John Cannell*, and Thorpe, *Jocelyn Field*. The synthetic dyestuffs and the intermediate products from which they are derived. 2nd edition. London 1913. pp. xvii + 423. 16s. net. (*Recd.* 24/5/13.) From the Authors.

Jellinek, *Karl*. Physikalische Chemie der homogenen und heterogenen Gasreaktionen unter besonderer Berücksichtigung der Strahlungs- und Quantenlehre sowie des Nernstschen Theorems. Leipzig 1913. pp. xiv + 844. ill. M. 30.—. (*Recd.* 6/5/13.)

From the Publisher: S. Hirzel.

Liebig, *R. G. Max*. Zink und Cadmium und ihre Gewinnung aus Erzen und Nebenprodukten. Leipzig 1913. pp. xvi + 598. ill. M. 30.—. (*Recd.* 15/5/13.) From the Publisher: Otto Spamer.

Lunge, *George*. The manufacture of sulphuric acid and alkali with the collateral branches. 4th edition. Vol. I. Sulphuric acid. [In three parts.] London 1913. pp. xxiv+1617. ill. £3 3s. net. (Reference.) From the Author.

Planck, *Max*. Vorlesungen über die Theorie der Wärmestrahlung. 2nd edition. Leipzig 1913. pp. xii+206. M. 7.50. (Recd. 15/5/13.) From E. Gardner, Esq.

Shepherd, *John William*. Qualitative determination of organic compounds. London 1913. pp. xvi+348. ill. 6s. 6d. (Recd. 14/5/13.) From the Author.

Tables annuelles de constantes et données numériques de chimie, de physique et de technologie. Publiées sous le patronage de l'Association internationale des Académies par le Comité international nommé par le VII^e Congrès de Chimie appliquée (Londres, 2 Juin, 1909). Volume II. Année 1911. Paris 1913. pp. xl+759. (Reference.) From the International Committee.

II. By Purchase.

Thorpe, *Sir Edward*. A dictionary of applied chemistry. Vol. IV. London 1913. pp. viii+727. ill. £2 5s. net. (Reference.)

III. Pamphlets.

Auerbach, *Friedrich*, and Pick, *Hans*. Die Alkalität von Pankreassaft und Darmsaft lebender Hunde. (From the *Arb. Kais. Gesund.*, 1912, 43.)

Eastick, *John Joseph*, Ogilvie, *James Pettigrew*, and Lindfield, *J. H.* Rapid and accurate determination of traces of iron in cane and beet sugar factory and refinery products. (From the *Internat. Sug. J.*, 1912, 14.)

Echols, *William Holding*. John W. Mallet: scholar, teacher, gentleman. (From the *Alumni Bull. Univ. Virginia*, 1913, [iii], 6.)

Holloway, *George Thomas*. Notes on the valuation of ores and minerals, and on metallurgical calculations. (From the *Trans. Inst. Min. Met.*, 1911-12.)

Kanolt, *C. W.* Melting points of fire bricks. (*Tech. Papers, Bur. Stands.*, 1912, No. 10.)

Pusa, *Agricultural Research Institute*. Report, 1911-12 (Including Report of the Imperial Cotton Specialist). Calcutta 1913. pp. 113.

Schröder, *F.* Beitrag zur Kenntnis der ölhaltigen Samen von *Ximenia Americana*. (From the *Arb. Kais. Gesund.*, 1912, 43.)

At the next Ordinary Scientific Meeting, to be held on Thursday, June 19th, 1913, at 8.30 p.m., there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Absorption spectra and chemical reactivity. Part III. Trinitrobenzene, trinitroanisole, and picric acid." By E. C. C. Baly and F. O. Rice.

"Derivatives of *o*-xylene. Part V. 5-Bromo-*o*-4-xylene and 6-bromo-*o*-4-xylene." By D. J. Bartlett and A. W. Crossley.

"The rotatory-dispersive power of organic compounds. Part III. The measurement of magnetic rotatory dispersion." By T. M. Lowry.

"The rotatory-dispersive power of organic compounds. Part IV. Optical and magnetic rotatory dispersion in some simple organic liquids." By T. M. Lowry.

"The action of ozone on cellulose. Part IV. Cellulose peroxide." By C. Dorée.

"The isomerism of *p*-azophenol." By P. W. Robertson.

"Sylvestrene. The constitution of *d*-sylvestrene and its derivatives." By W. N. Haworth, W. H. Perkin, and O. Wallach.

"Synthesis of pinacones." By W. Parry.

"The refractivities of acenaphthene and its monohalogen derivatives." By H. Crompton and W. R. Smyth.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 19th, 1913.

Biggart, William Love,

Rossarden, Kilmacolm, Renfrewshire.

Analytical Chemist. I am 47 years of age; a partner of McCowan & Biggart, Analytical and Consulting Chemists and Analysts to the Greenock and Lancashire Sugar Associations, etc. I am one of the public Analysts under the Food and Drugs Acts for the Counties of Ayr, Argyll, Bute, the Burgh of Greenock, and 23 (twenty-three) other Burghs. I am also Deputy Analyst under the Fertilisers and Feeding Stuffs Act for the Counties of Ayr, Argyll, Bute, and have been in the practice of chemistry for about 30 years.

John Wm. Biggart.

T. L. Patterson.

A. Smith.

Thomas S. Dick.

Robert Mills.

Brooks, Archibald Joseph,

“Melrose,” St. Lucia, B.W.I.

Assist. Supt. Botanic and Agricultural Experiment Stations, St. Lucia, B. W. Indies. Laboratory Assist. and Student, Swindon and North Wilts Technical Schools, 1896–1901. Lecturer in Agricultural Chemistry, Agric. School, Dominica, B.W.I., 1903–1911. Now engaged in work partly of an agricultural-chemical nature, and desirous of obtaining the Journal, and so keeping in touch with recent work, especially in Agricultural Chemistry.

Francis Watts.

Gilbert Auchinleck.

A. T. Cameron.

A. E. Collens.

W. R. Bird.

T. C. Davison.

Joseph de Verteuil.

Davies, William Rhys,

Swan Arcade, Bradford; and at Ilkley, Yorks.

Analytical Chemist. Sir Henry Mitchell Exhibitioner, Bradford

Technical College, 1899–1901. In public practice from 1902 to 1913. Analyst to the Bradford Chamber of Trades, and retained by many large Industrial Firms.

A. G. Green.

J. B. Cohen.

A. G. Perkin.

Walter M. Gardner.

Barker North.

Drummond, Jack Cecil,

8, Little Heath, Old Charlton, Kent.

Research Assistant, Physiological Laboratory, King's College, London. B.Sc. (Lond.), 1st Class Hons. Chemistry, Oct. 1912 (Internal); Research Assistant to Dr. W. Bain, M.D., Physiological Laboratory, King's College, London, Nov. 1912—present time.

J. T. Hewitt.

R. W. Merriman.

Clarence Smith.

A. D. Mitchell.

F. G. Pope.

W. D. Halliburton.

O. Rosenheim.

Freeman, Horace,

1535, Robson St., Vancouver, B.C.

Analytical Chemist and Assayer. Major Scholar, Birmingham (Eng.) Municipal Technical Day School, 1901–1905. Asst. Research Chemist, the British Cyanides Co., Ltd., Oldbury, England, 1905–1910. Assayer-in-charge, The Canadian Bank of Commerce Assay Office, Dawson, Yukon Territory, 1911. Chief Assayer, The Dominion of Canada Assay Office, Vancouver, British Columbia, 1912.

E. C. Rossiter.

Douglas F. Twiss.

T. Slater Price.

Lionel M. Jones.

Daniel Arkell.

Glenday, Roy Gonçalves,

Emmanuel College, Cambridge.

Assistant Demonstrator. B.A. (Cantab.), 2nd Class Natural Science Tripos, Pt. II.

W. J. Pope.

W. H. Mills.

F. E. E. Lamplough.

J. G. M. Dunlop.

W. J. Sell.

E. J. Holmyard.

Hutchinson, James Joseph,

"Cecilville," Conquer Hill, Dollymount, Co. Dublin.

Analytical Chemist and Lecturer. Devised Apparatus Measuring Vapour Pressure: Paper, Royal Dublin Society. Lecturer and Demonstrator, Organic and Applied Chemistry, City of Dublin Technical Schools (12 years); sometime Research Assistant, Royal

College of Science, Dublin (Sir W. N. Hartley); Chief Chemist, Messrs. W. and R. Jacob & Co., Biscuit Manufacturers (6 years).

Gilbert T. Morgan.

James H. Pollok.

Jos. Reilly.

James C. Philip.

P. Bertram Foy.

Lefebure, Victor,

25, Belitha Villas, Barnsbury, N.

Student in Research, University College. Graduate of University College, London; B.Sc. Hons. Chem.; Research Student holding Tufnell Scholarship; Researching with Sir William Ramsay and Dr. Gray on some "Adsorption" effects.

J. Norman Collie.

H. E. Annett.

Samuel Smiles.

R. Whytlaw-Gray.

Irvine Masson.

Macnaughtan, Duncan James,

31, Clonmel Road, Fulham, S.W.

Metallurgical Chemist, Aero Metal Syndicate, 100-102 Victoria Street, S.W. 1906-1909, general course of chemistry and engineering at South-Western Polytechnic, Chelsea. Obtained August, 1909, position as metallurgical chemist; continued chemical studies at same institute. Examination results: 1st Class Honours, Board of Education, Metallurgy, 1911; 1st Prize and Bronze Medal, Ordinary Grade, 1910, and 1st Prize and Silver Medal, Honours Grade, 1911, Iron and Steel Manufacture, City and Guilds Institute; 1st Prize and Bronze Medal, Electro Metallurgy, 1912, City and Guilds Institute. At present engaged in metal research. Appointed Head Chemist to Aero Metal Syndicate, April, 1910.

J. B. Coleman.

F. H. Lowe.

J. C. Crocker.

J. H. Coste.

E. T. Shelbourn.

Mahamadi, Ghulam Ali,

(Elliehpur, Berar, India.) *Present address:* 144, Jerningham Road, New Cross, London, S.E.

Government of India Technical Scholar. Graduate of the Bombay University; Training in the analytical work in the Chemical Laboratory of the Imp. Ag. Research Institute, Pusa, India; Assistant Lecturer in Chemistry in the Ag. College, Nagpur, C.P., India; Special course of Oils and Fats Chemistry in Battersea Polytechnic, London; Special study of Oils and Fats and their products.

John Wilson.

W. H. Simmons.

J. L. White.

C. T. Bennett.

C. Dorée.

Maxwell, Marius,

Bettiah, India, or 77, Lawrie Park Road, Sydenham, London.

Technical Superintendent and Chemist of the United Provinces Sugar Factory, India. Certificated Analytical Chemist, Brunswick Sugar Institute, Germany; Certificated Ingénieur, Swiss Polytechnic, Zürich; Membre de l'association des Chimistes de Sucrerie de France.

Arthur Smithells.

H. M. Dawson.

J. B. Cohen.

W. H. Perkins.

W. Lowson.

Oliver, Ralph Richard,

Portsmouth, Virginia, U.S.A.,

Chemist and Paper Manufacturer, Southern Fibre Co., Portsmouth, Va., U.S.A. Completed the two years' Paper-making Course at the Municipal School of Technology, Manchester. Research in Cotton Seed Hull Fibre, with the result of its manufacture into a suitable absorbent paper.

Harold Moore.

F. S. Sinnatt.

Stanley J. Peachey.

E. L. Rhead.

F. G. Richards.

Phillips, Percy Bernard,

The London Hospital, E.

Pharmacist. Having obtained the Minor and Major qualifications of the Pharmaceutical Society, I desire to keep in touch with Chemical Research.

C. H. Hampshire.

F. W. Crossley-Holland.

Arthur W. Crossley.

Herbert A. Mills.

Chas. Horne Warner.

Saunders, William Gilbert,

34, Hanover Street, Liverpool.

Works Chemist. Associate of the Institute of Chemistry. Pharmaceutical Chemist.

Edward C. Cyril Baly.

A. W. Titherley.

F. G. Donnan.

C. H. Hampshire.

Arthur W. Crossley.

Smith, Montagu George,

8, Cross Road, Bromley Common, Kent.

Dispenser and X-Ray Operator at the Infirmary, Lewisham, S.E., 1894 to present date. I desire to keep in touch with modern chemical research.

G. Stallard.

C. Gerland.

H. Montague Heasman.

H. E. Dryden.

Frank H. Plews.

C. J. Regan.

W. Chas. Sayers.

C. H. Hampshire.

Thomas, Ebenezer Rees,

Emmanuel College, Cambridge.

Research Student and Assistant Demonstrator in Chemistry at the University Laboratory, Cambridge. M.Sc. (Wales) in Chemistry; Certificate of Research (Cambridge). Author of communications to the Society.

William J. Pope.

J. G. M. Dunlop.

W. J. Sell.

W. H. Mills.

F. W. Dootson.

J. E. Purvis.

Thorne, Percy Cyril Lesley,

Borough Road Training College, Isleworth.

Tutor in Chemistry. Senior Science Scholar, Corpus Christi College, Cambridge; 2nd Class, 1st Pt., Nat. Sciences Tripos, 1911; 3rd Class, 2nd Pt., Nat. Sciences Tripos, 1912; Tutor in Chemistry, Borough Road College, Isleworth, 1913.

H. J. H. Fenton.

S. Ruhemann.

W. J. Pope.

Charles T. Heycock.

J. E. Purvis.

Twomey, Jeremiah,

21, Onslow Road, Elm Park, Liverpool.

Research Chemist in Flour Mills (W. Vernon & Sons, Birkenhead); also Consulting and Analytical Chemist to a Farming Co. (Shotwick Park Farming Co., Chester). B.Sc. Hons. Chem. (1st Class), Liverpool; Le Blanc Medallist for Applied Chemistry. Researched under Prof. Donnan for one year on $\text{CaCO}_3, \text{CO}_2, \text{H}_2\text{O}$ equilibrium; Osmotic Pressure of Soap Solutions. Awarded degree of M.Sc. Now in above position.

F. G. Donnan.

A. W. Titherley.

Edward C. Cyril Baly.

A. J. Allmand.

R. E. Slade.

Walker, John Stewart,

Hiratsuka, Sagami, Japan.

Laboratory Superintendent of the Japanese Explosives Co., Ltd. Trained at Glasgow and West of Scotland Technical College ($4\frac{1}{2}$ years); Antrim Iron Ore Co., Ltd., Belfast (2 years); Nobel's Explosives Co., Ltd., Ardeer (2 years); Japanese Explosives Co., Ltd., Japan (5 years).

G. G. Henderson.

Thomas Gray.

F. J. Wilson.

A. Campion.

I. M. Heilbron.

Watson, Edwin Longstaff,
Nawabganj, Cawnpore, India.

Works manager. Minor and Major Qualifications of the Pharmaceutical Society.

Arthur W. Crossley.

C. H. Hampshire.

Charles Gilling.

Charles H. Warner.

James C. Philip.

Wilson, Ernest John, M.A. (Cantab.), F.I.C.,
Osborne House, Wisbech, Cambs.

Analytical Chemist. 1898—1902, at Magdalene Coll., Camb. ; took B.A. in 1901 in Natural Sciences Tripos. 1902—1903, Junior Assistant to J. T. Norman, Analyst, 23, Leadenhall Street, E.C. 1903—1906, at King's Coll., London, under Prof. J. M. Thomson ; passed A.I.C. (Mineral Chemistry) in April, 1906. 1906—10, Senior Assistant to the late R. Barklie, Public Analyst for Belfast ; Lecturer in Chemistry for two years to Belfast Technical Institute (evening classes). 1911, private practice in Belfast. 1913, Works Chemist to Wm. Wilson & Sons, Wisbech.

Henry R. Lyell.

Herbert Jackson.

John M. Thomson.

Patrick H. Kirkaldy.

Henry L. Smith.

Young, Thomas Howard,
118, Scotia Street, Winnipeg, Man., Canada.

Analytical Chemist. Three years Demonstrator under Dr. Slater Price, Organic Chemical Laboratory, Municipal Technical School, Birmingham, England ; Three years Research Chemist under R. Threlfall, F.R.S., Messrs. Albright & Wilson, Chemical Manufacturers, Oldbury, England ; Five years Chief Assistant Chemist, Canadian Pacific Railway (Western lines—Fort William to Vancouver). At present Acting Chief Chemist, Canadian Pacific Railway (Western lines).

T. Slater Price.

H. E. Bletcher.

Matthew A. Parker.

Douglas F. Twiss.

Lionel M. Jones.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29

No. 418.

Thursday, June 19th, 1913, at 8.30 p.m., Prof. W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT announced that, in future, a list of the papers to be read at each Ordinary Scientific Meeting will be advertised in the *Morning Post* on the Wednesday previous to the day of meeting.

Messrs. A. J. Berry and R. Robison were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Alan Milsom Bailey, Lanhill, Chippenham.

George Bernard Butler, 10, Malvern Street, Elswick Road, Newcastle-on-Tyne.

Alexander Houghton Hay, Essex Wharf, Narrow Street, Limehouse, E.

Harold Frank Tayler, 105, Barrow Road, Streatham, S.W.

A ballot for the election of Fellows was held, and the following were subsequently declared duly elected:

William Love Biggart.
Archibald Joseph Brooks.
William Rhys-Davies.
Jack Cecil Drummond, B.Sc.
Horace Freeman.
Roy Gonçalves Glenday, B.A.
James Joseph Hutchinson.
Victor Lefebure, B.Sc.
Duncan James Macnaughtan.
Ghulam Ali Mahamadi.
Marius Maxwell.

Ralph Richard Oliver.
Percy Bernard Phillips.
William Gilbert Saunders.
Montagu George Smith.
Ebenezer Rees Thomas, M.Sc.
Percy Cyril Lesley Thorne, B.A.
Jeremiah Twomey, M.Sc.
John Stewart Walker.
Edwin Longstaff Watson.
Ernest John Wilson, M.A.
Thomas Howard Young.

Of the following papers, those marked * were read:

- *189. "Absorption spectra and chemical reactivity. Part III. Trinitrobenzene, trinitroanisole, and picric acid." By Edward Charles Cyril Baly and Francis Owen Rice.

The absorption spectra of trinitrobenzene, trinitroanisole, and picric acid were described, and it was shown how the closed force fields surrounding the molecules of these substances are opened up by the use of various basic solvents. In a previous paper (T., 1912, 101, 1469) a theory of fluorescence was put forward based on the existence of several stages in the opening up of these closed systems. Whereas previously only one stage had been recognised, three stages have been proved to be produced with the three trinitro-compounds. It was shown how the results explain the formation of the picrates of the hydrocarbons and the nitration of the aromatic compounds.

DISCUSSION.

Referring to the views on the origin of residual affinity advanced by Prof. Baly, and to the remark that previous explanations were "not satisfactory and connected," Dr. FLÜRSCHHEIM said that he was unable to discern any substantial difference between Prof. Baly's views and those he had himself published years before. In support of this he read some passages from one of his papers (*J. pr. Chem.*, 1907, [ii], 76, 185), in which the idea of an equilibrium between the combined and free affinity of an atom was clearly developed. He had repeatedly referred to this publication in subsequent communications to the Society, and based on it some further chemical generalisations, some of which he had already been able to confirm by chemical experiment.

Prof. Baly had merely used different words to express the same meaning. Thus, the term "force lines" used by Baly had already been previously employed by Hugo Kauffmann as a synonym for the term "chemical energy" adhered to by him (Dr. Flürscheim), and it was difficult to imagine chemical energy acting otherwise than in force lines. Similarly, the term "principal and secondary valencies," introduced by Werner and used by Prof. Baly, was, when applied to the problem of residual affinity, merely a synonym for the term "affinity" used by him (Dr. Flürscheim).

He would therefore be glad to know in what way the views published by Prof. Baly differed from, and represented an advance on, those which he had himself published previously.

- *190. "Derivatives of *o*-xylene. Part V. 5-Bromo-*o*-4-xylenol and 6-bromo-*o*-4-xylenol." By Arthur William Crossley and Dorothy Jessie Bartlett.

5-Bromo-*o*-4-xylenol, prepared by replacing the amino-group in 5-amino-*o*-4-xylenol by bromine, crystallises in glistening needles, melting at 80°. The *benzoyl* derivative forms transparent plates, melting at 51°, and the *o*-nitrobenzoyl derivative crystallises from ethyl acetate in transparent, rectangular plates, melting at 151—152°.

6-Bromo-*o*-4-xylenol was prepared from 5-nitro-3-*o*-xylidine by replacing the amino-group by a bromine atom and the nitro-group by hydroxyl. It separates from light petroleum (b. p. 80—100°) in masses of silken needles, melting at 103°. The *benzoyl* derivative crystallises from methyl alcohol in transparent, six-sided plates, melting at 85°, and the *o*-nitrobenzoyl derivative forms glistening needles, melting at 132°.

- *191. "The presence of neon in hydrogen after the passage of the electric discharge through the latter at low pressures. Part II." By John Norman Collie and Hubert Sutton Patterson.

Since the authors' former communication on this subject (T., 1913, 103, 419), many further experiments have been made. That electrodes are necessary for the production of neon and helium has been disproved; for if a powerful oscillating discharge be passed through a coil of wire wound round a glass bulb containing a little hydrogen, helium with some neon can be detected in the residual hydrogen. It is necessary to free the gas in the bulb as completely as possible from mercury vapour. The experiment was frequently repeated in the same bulb, and even after many weeks' working, helium and neon could still be obtained from the apparatus. The hydrogen and oxygen used in these experiments was repeatedly tested in quantities up to 100 c.c., but not a trace of helium or neon was found. The experimental bulb before use was heated to 250° and washed out with oxygen; the oxygen residue did not show the presence of either helium or neon.

Also an apparatus was made where the tube through which the discharge took place was surrounded by a vacuous outer tube. The wires connected to the electrodes in the inner tube passed through the outer tube in glass tubes, so that there could be no discharge from any electrodes in the outer vessel; in this case, also, helium and some neon were found in the outer vessel. The above experiment was made in the following manner. After the tube had been

externally heated and pumped until no more gas would come off, a strong current was passed. At once hydrogen began to be evolved from the electrodes; this was pumped off, and an electric spark passed through it to see whether any oxygen was present. A very small contraction occurred; 4.6 c.c. remained. This was then gradually put back into the tube, whilst a powerful current was passed through the tube, which was at the same time externally heated with a gas flame. At the end of three hours' sparking, 2.2 c.c. of gas remained. This was again put back into the tube and the sparking repeated; at the end of another three hours it had shrunk to about 1.0 c.c., and by further treatment it went to 0.4 c.c. This hydrogen contained a trace of neon. At this point a crack appeared in the inner tube. From the outer tube only 0.4 c.c. had been pumped off; this contained both helium and neon. The inner tube was broken up at once, the two aluminium electrodes were put into a hard glass tube, and fused by a blowpipe in a vacuum; 0.2 c.c. of hydrogen was collected. The glass ends of the inner tube were powdered and also heated by means of a blowpipe in a hard glass tube that had been entirely pumped out. Too small an amount of hydrogen to be measured was pumped off. From the above experiment $4.6 - 1.0 = 3.6$ c.c. of hydrogen had apparently disappeared. In the capillary tube between the two ends of the inner tube some black substance had collected where the tube had been very highly heated by the electric discharge. This substance was carbon, for on heating it with a little oxygen it suddenly burnt away with a bright flash, and the oxygen gave a milkiness with baryta solution. Many experiments have also been made with a double tube so constructed that mercury can be run up so as to fill the outer vessel, and drive the gas there up into a small capillary tube with a platinum wire fused through the end of it. The gas can under these conditions be examined by means of an electric discharge from the platinum wire to the mercury. During the whole of an experiment gas is perpetually appearing in the outer tube. It consists largely of hydrogen, together with traces of helium and neon, and of a gas that gives a spectrum of carbon. If it is sparked it rapidly decreases in volume, usually to about one-half and sometimes even less, the carbon spectrum almost entirely disappears, and the hydrogen (and the traces of helium and neon) remain. This same phenomenon also invariably occurs when testing for helium and neon. After the residual hydrogen has been exploded with excess of oxygen, and the residual oxygen has been absorbed by charcoal cooled in liquid air, the gas that remains should be pure helium or neon or a mixture of the two. The spectrum, however, is always a carbon spectrum, and it is only

after sparking for some time that the carbon spectrum goes and the pure spectrum of helium and neon takes its place. There is always at the same time a diminution usually of over 50 per cent. in the volume of the gas. This gas also is produced in the bulb, round which a wire has been coiled, and through which an oscillating discharge has been passed. It also is produced in a tube containing a piece of platinum foil, placed in the focus of a concave cathode of aluminium, bombarded by cathode stream, so that it becomes red-hot. At first, hydrogen is given, then hydrogen mixed with helium and some neon, then less hydrogen and helium, and some of the gas already mentioned that gives a carbon spectrum. After this apparently no more helium is produced, but an increasingly relatively larger amount of the gas giving the carbon spectrum. If this gas is sparked in contact with mercury vapour, it almost instantaneously disappears, and it has been found impossible to reproduce it, by heating the tube, or varying the pressure in the tube.

As it can be separated from the hydrogen in which it is found by exploding with excess of oxygen and removing that excess by means of charcoal cooled with liquid air, it appears to be a highly uncondensable gas, and not readily oxidised. This result, taken in conjunction with the fact that it gives a carbon spectrum, is very difficult to explain. It is possible that this gas may be the same as that discovered by Sir J. J. Thomson and called by him X_3 .

Various experiments have also been made with electrodes other than aluminium. In the case of copper, interesting results were obtained. The hydrogen seemed to disappear more rapidly than when aluminium electrodes were used. Possibly this is due to the fact that a more powerful current can be passed through the tube, and the electrodes therefore heated to a higher temperature. The splashed copper was in parts of a black colour. Even after as much as 5 c.c. of hydrogen had been absorbed by a tube, no amount of heating made the gas come off again. The copper splash was dissolved in aqua regia, and evaporated to dryness, some water and a little hydrochloric acid added, and the clear solution of the copper salt was then tested with barium chloride. A small, white precipitate was obtained. This has been repeated many times; the copper splash always gives this precipitate. Presumably it is barium sulphate; but it is somewhat difficult to prove the presence of sulphur in the minute amount produced. The actual amount from four different experiments weighed about one-tenth of a milligram. Some of it was heated with a little sodium carbonate and carbon, and gave a faint brown stain on silver; also, with hydrochloric acid, a very faint odour of hydrogen sulphide. As

ordinary glass contains traces of sulphur, four more experiments were made with lead glass tubes that are quite free from sulphur. Again in every case a precipitate was obtained in acid solution by barium chloride. Three other tubes with respectively magnesium, platinum, and palladium electrodes all gave this precipitate. Every conceivable precaution was taken to test the metals, the reagents, and the electrodes for sulphur, and, except in the case of soda-glass tubes, sulphur was invariably absent.

The results at present arrived at from the experiments given in this note are the following:

(1) Electrodes apparently are not necessary for the production of the helium and neon.

(2) Hydrogen in considerable quantities can be made to apparently entirely disappear in tubes through which a heavy discharge passes.

(3) A gas is produced in the tubes that gives a carbon spectrum. It entirely disappears when sparked in contact with mercury. It is not readily condensed by charcoal cooled in liquid air, nor easily oxidised by sparking with oxygen.

(4) When copper, platinum, palladium, or magnesium are splashed off in an ordinary vacuum tube containing hydrogen, something is produced that, after dissolving in aqua regia, gives a precipitate in acid solution with barium chloride.

Note.—Only one of the authors (J. N. C.) is responsible for the statement that the metallic splashes give, after solution in acids, a precipitate with barium chloride. Since the paper was read he has made further experiments that probably account for its production.

(1) Copper electrodes were used. The solution of the splash in acids was evaporated in *silica* vessels. *No precipitate was obtained.*

(2) The same tube was used again, and the solution of the splash was divided in half. One half (*a*) was evaporated in glass test-tubes, the other half (*b*) was evaporated in *silica* vessels: (*a*) gave a precipitate, (*b*) gave no precipitate.

A blank experiment was made with the acids and considerable evaporation in glass test-tubes, and a precipitate was obtained with barium chloride in acid solution.

The hydrochloric acid had been boiled with, and then distilled from, solid barium chloride, and the nitric acid had been treated in the same way with barium nitrate.

There also might be another explanation of the precipitate. The copper electrodes were sealed to the platinum by a little silver solder; some of the silver splashes off; this gives silver chloride,

that on evaporation with strong hydrochloric acid dissolves, and is reprecipitated on dilution and addition of barium chloride.

***192. "The rotatory dispersive power of organic compounds.**

Part III. The measurement of magnetic rotatory dispersion."

By Thomas Martin Lowry.

A description was given of apparatus and methods for the measurement of magnetic rotations over a wide range of the visible spectrum.

***193. "The rotatory dispersive power of organic compounds.**

Part IV. Magnetic rotation and dispersion in some simple organic liquids." By Thomas Martin Lowry.

Numerical values were given for the magnetic rotation and dispersion in (1) inactive primary alcohols, (2) active secondary alcohols prepared by Dr. R. H. Pickard, (3) fatty acids, including active valeric acid, (4) ketones, (5) esters and paraffins prepared by Prof. Young, (6) carbon disulphide.

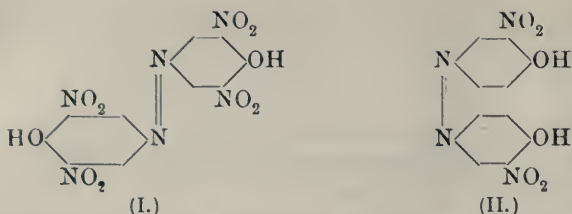
***194. "The isomerism of *p*-azophenol."**

By Philip Wilfred Robertson.

p-Azophenol, $\text{HO} \cdot \text{C}_6\text{H}_4 \cdot \text{N} : \text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{OH}$, as ordinarily prepared, forms yellow crystals containing one molecule of water; there appear, however, to be two yellow modifications, one of which yields, on heating, the anhydrous compound as a dark green, the other as a brick-red variety. Both of these forms have been shown to be stable in dry air under ordinary conditions; at higher temperatures the red is converted into the green, the transition temperature being about 50° . This is possibly not a case of polymorphism, because the difference seems to persist in solution.

In addition to this α -azophenol, Willstätter has obtained, by oxidation and subsequent reduction, a β -modification, a red substance incapable of being reconverted into the original compound by physical means. Hantzsch has shown that both substances have exactly the same absorption spectra, and calls this a case of homochromisomerism.

The chemical reactions of the two substances have now been examined. On bromination, they yield different tetrabromoderivatives, melting at 252° and 271° , and these have also identical absorption spectra. On nitration, α -azophenol yields a tetranitrocompound (I), whilst the β -modification, even with considerable excess of nitric acid, forms only a disubstituted derivative (II):



It is possible that this difference is due to stereoisomerism, as is indicated in the above formulæ.

DISCUSSION.

Prof. MELDOLA considered that Dr. Robertson had made out a good case in favour of the stereoisomerism of the two forms in the sense of their being the *syn*- and *anti*-modifications. He had no doubt the author had considered the possibility of quinonoid isomerism, since one-half of the molecule admitted of such rearrangement. He asked whether this point had been tested by checking the mobility of the hydroxylic hydrogens by preparing the methyl derivatives, and, if so, whether the two isomerides gave isomeric or identical methyl derivatives.

In reply to Prof. Meldola, Dr. ROBERTSON said that the fact of the two isomerides having the same absorption spectrum precluded the possibility of either possessing a quinonoid constitution. The author differed from Prof. Baly in his contention that an equilibrium mixture in solution might yield two different substances on removal of the solvent, according to whether one started from one or the other isomeride.

*195. "The action of ozone on cellulose. Part IV. Cellulose peroxide." By Charles Dorée.

Ozone acting on purified cotton-cellulose was stated to furnish a peroxide, recognised by its oxidising action on potassium iodide solution (T., 1912, 101, 498). Doubts having been cast on the existence of this product, the question has been reinvestigated. In the absence of water, a small amount of peroxide alone is produced, but in air-dry material the quantity of peroxide formed is very much greater, and at the same time the solid insoluble acid and oxycellulose are formed (*loc. cit.*). The amount of "active oxygen" fixed by air-dry cotton, mercerised cotton, and lustra-cellulose after eighteen hours' exposure to ozone was 0.0056, 0.0106, and 0.0248 per cent. respectively. The peroxide is slowly decomposed on treatment with water, hydrogen peroxide being produced. It is decomposed to the extent of 25 per cent., after heating for two

hours at 37°, and almost entirely after two hours at 95°. The activity soon disappears if the material is kept in the air, but persists for some weeks in a dry atmosphere. The peroxide acts strongly on a photographic plate, sharp negative images of the fibres being obtained in twenty days at 14°, or in six hours at 37°. These properties recall the photographic action of the natural woods described by Russell (*Phil. Trans.*, 1904, **197**, 281, etc.), and were shown to be due probably to a similar cause, namely, the gradual production of hydrogen peroxide.

The question of the position in the cellulose complex at which the peroxide oxygen may be attached was discussed, together with the part played by the peroxide in the oxidation of cellulose by ozone.

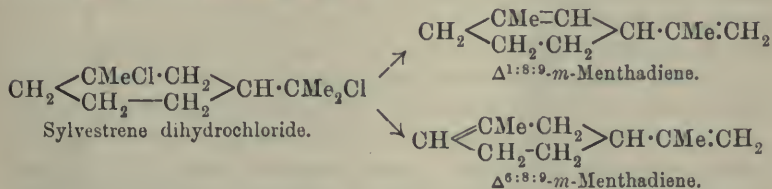
DISCUSSION.

Mr. C. F. Cross believed that the author's paper would be found to explain these observations in terms of a cyclic formula for the unit (C_6) constituent group of the cellulose complex with the "potential" unsaturated position.

He called attention to current articles by H. Gebhardt (especially *Chem. Zeit.*, 1913, **37**, 663), discussing the constitution of cellulose from the point of view of its affinities for colouring matters. This author arrived independently at similar conclusions.

*196. "Sylvestrene. The constitution of *d*-sylvestrene and its derivatives." By Walter Norman Haworth, William Henry Perkin, jun., and Otto Wallach.

The authors have been engaged on a detailed investigation of *d*-sylvestrene, prepared from the dihydrochloride by the elimination of hydrogen chloride, and they find that it is mainly a mixture of $\Delta^{1:9:9}$ - and $\Delta^{6:8:9}$ -*m*-menthadiene:



They have also prepared a large number of derivatives of sylvestrene and determined their constitutions.

197. "The refractivities of acenaphthene and its monohalogen derivatives." By Holland Crompton and Wilhelmina Rebecca Smyth.

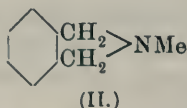
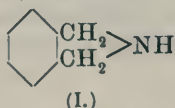
The following values have been obtained for the molecular refractions of acenaphthene and its monohalogen derivatives:

	M_c .	M_D .	M_F .
Acenaphthene	50·84	51·33	52·84
3-Chloroacenaphthene	55·53	56·07	57·55
3-Bromoacenaphthene	58·97	59·58	61·22
3-Iodoacenaphthene	63·42	64·10	66·02

The molecular refraction, M_c , of acenaphthene, calculated from that of naphthalene, is 50·94, and in the case of the halogen derivatives, the values calculated for the molecular refractions from that of acenaphthene agree with the observed. There is therefore nothing abnormal in the behaviour of these compounds.

198. "The formation of cyclic bases from aromatic imides." (Preliminary note.) By Edward Hope and Frederick Russell Lankshear.

The authors have studied the electrolytic reduction of phthalimidine and of *N*-methylphthalimidine (prepared from phthalimide and *N*-methylphthalimide respectively), and have succeeded in obtaining excellent yields of dihydroisoindole (I) and *N*-methyl-dihydroisoindole (II):



The properties of dihydroisoindole thus prepared agree with those given by Gabriel and Pinkus (*Ber.*, 1893, **26**, 2210) and by Fränkel (*Ber.*, 1900, **33**, 2809). As stated by the latter, methyl iodide reacts with dihydroisoindole, giving a mixture of the hydriodide and the methiodide.

N-Methyldihydroisoindole is a colourless oil with a strong basic odour, and boils at 195—196°/750 mm. It is very soluble in water, and readily distils over in steam, separating in the distillate as a sparingly soluble hydrate, which contains two molecules of water.

The compound also reacts vigorously with methyl iodide, giving a quantitative yield of the methiodide (m. p. 246°). This is identical with the methiodide obtained under similar conditions from dihydroisoindole.

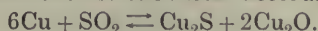
This electrolytic reduction process renders simple the preparation of isoindole bases, which have hitherto been obtained only by

somewhat laborious methods. The authors are engaged in an investigation of these bases, and are carrying out experiments with a view to apply the reduction process to a variety of similar imides.

199. "The action of sulphur dioxide on copper at high temperatures."

By Clifford Morgan Stubbs.

The depression of the freezing point of copper by dissolved sulphur dioxide has been found to be about 2.54 times that expected if the molecules of the gas remained intact in the solution. This result can be explained on the hypothesis of a partial reaction of the dissolved gas with the molten metal according to the equation:



Complete reaction would give three times the depression calculated from the molecular formula SO_2 .

It has been shown that this hypothesis of an equilibrium in the molten metal can be brought into harmony with the solubility results of Sieverts and Krumbhaar. The equilibrium pressures of sulphur dioxide in the univariant system Cu , Cu_2O , Cu_2S (all as solids) have also been measured between 700° and 1050° , the pressure rising in this range of temperature from less than one atmosphere to about seven atmospheres.

200. "The change of colour of metallic haloid solutions."

By Charles Scott Garrett.

Solutions of coloured metallic haloids in general undergo considerable changes of colour on varying the concentration, temperature, or solvent, as well as on the addition of colourless haloid salts. The phenomenon is connected with the presence of varying valency in the parent metal.

It was pointed out that these changes most probably are due to the formation of complex radicles of two types, acidic and metallic radicles, and by quantitative spectrophotometric measurements it has been shown how these two types of complex formation may be distinguished. Copper haloids form acidic complexes, whilst chromium haloids form metallic complexes, but the solvent must be regarded as playing some part in the change.

Bands of selective absorption due to the complexes were found in the case of cupric bromide, cupric chloride, and nickel bromide solutions, by photographing the saturated aqueous solutions in very thin layers.

In the typical cases of copper and chromium haloid solutions it was shown that the various parts of the absorption spectra may be attributed to various entities in the molecules of the salts.

201. "Hydroxyazo-compounds. The action of semicarbazide hydrochloride on the *p*-quinones." By Isidor Morris Heilbron and James Alexander Russell Henderson.

As indicated in a recent communication (P., 1912, 28, 256), the condensation products obtained by the action of semicarbazide hydrochloride on the *p*-quinones in equimolecular quantities must, from spectrographic evidence, be regarded as hydroxyazo-derivatives. A further examination of these condensation products has, however, made evident that under certain conditions a few of these hydroxyazo-compounds undoubtedly react tautomerically as semicarbazones. The authors find further that on salt-formation the hydroxyazo-compounds assume a quinonoid constitution, as is proved by the great similarity of their absorption curves with the typical quinone, tetraphenylquinodimethane. This compound shows a very characteristic band of great persistence in $M/10,000$ -solution, differing in position from the band of *p*-benzoquinone and its homologues, but resembling closely the absorption curves of the nitrophenol salts, and the authors adduce from this that such salts are undoubtedly quinonoid.

A direct relationship has also been found to exist between the molecular weight and position of the absorption band in this series of similarly constituted compounds.

202. "The alkaloids of ipecacuanha." (Preliminary note.)
By Francis Howard Carr and Frank Lee Pyman.

In spite of the medicinal importance of ipecacuanha, very little is known about the alkaloids which it contains, although the subject has received a considerable amount of attention. A number of earlier investigations were carried out with a purified amorphous total alkaloid, formerly known as "emetine," but later Paul and Cownley (*Pharm. J.*, 1894, [iii], 24, 111) showed that this product contains at least two alkaloids, emetine and cephaeline, the latter being a phenolic base, and described methods for their separation and purification. They attributed to emetine the formula $C_{30}H_{44}O_4N_2$ or $C_{15}H_{22}O_4N_2$, and the cephaeline, $C_{28}H_{40}O_4N_2$ or $C_{14}H_{20}O_4N_2$, whilst O. Hesse (*Pharm. J.*, 1898 [iv], 7, 98), repeating the work at their request, preferred the formula $C_{30}H_{42}O_4N_2$ for emetine and $C_{28}H_{38}O_4N_2$ for cephaeline. Hesse showed that emetine contains four methoxyl groups, whilst the results for cephaeline lie between those required for two and three.

The subject has recently been reinvestigated by Keller (*Arch. Pharm.*, 1911, 249, 512), who has brought out the important result

that emetine forms a nitrosoamine, and therefore contains an imino-group. He regards it as a secondary tertiary base, containing two methoxyls and at least one hydroxyl group.

In the course of an extended investigation of these alkaloids, the authors have obtained results having an important bearing on the constitution of emetine and cephæline, and think it well to record briefly at the present stage some of their principal conclusions.

A large number of analyses of emetine, and of its hydrochloride, hydrobromide, hydriodide, and nitrate have now been carried out, and these indicate the formula $C_{29}H_{40}O_4N_2$ for this base. This formula is also in better agreement on the whole with the few results obtained by previous investigators than any of the formulæ suggested by them. Cephæline is probably correctly represented by the formula $C_{23}H_{38}O_4N_2$. These formulæ, which are supported by molecular-weight determinations, indicate that each alkaloid contains two nitrogen atoms.

In the stable neutral salts, the bases are combined with two equivalents of acid. Evidence of the existence of basic salts has also been adduced. In each base both nitrogen atoms are present as imino-groups; and these alkaloids are therefore dissecondary bases.

Emetine contains four, and cephæline three, methoxyl groups, whilst the latter also contains a phenolic hydroxyl group. All the oxygen atoms contained in them are thus accounted for. Both alkaloids are optically active, the bases being levorotatory, emetine having $[\alpha]_D -22^\circ$, and cephæline $[\alpha]_D -18^\circ$, whilst the salts are dextrorotatory, anhydrous emetine hydrochloride $[\alpha]_D +16^\circ$ corresponding with $[\alpha]_D +18^\circ$ for the basic ion.

Emetine yields, on oxidation with ferric chloride in aqueous solution, a scarlet, crystalline hydrochloride, which is termed *rubremetine hydrochloride*. Being formed by the removal of eight hydrogen atoms from emetine, it has the formula $C_{29}H_{32}O_4N_2 \cdot HCl \cdot 6H_2O$. It melts at $127-128^\circ$ (corr.), contains four methoxyl groups, and is monobasic. When emetine is oxidised with a large amount of potassium permanganate in aqueous acetone solution, 6:7-dimethoxyisoquinoline-1-carboxylic acid is formed, identical with the substance previously obtained by Goldschmidt by the oxidation of papaverine; *m*-hemipinic acid has also been observed amongst the oxidation products.

Cephæline, on oxidation, behaves differently from emetine, ferric chloride giving rise to two crystalline oxidation products: (i) a *hydrochloride*, $C_{24}H_{24}O_7N_2 \cdot HCl \cdot 5H_2O$, melting at $249-250^\circ$ (corr.), and containing three methoxyl groups but no hydroxyl group, (ii) a *hydrochloride*, $C_{17}H_{21}O_6N \cdot HCl \cdot 4H_2O$, melting and decom-

posing at 158° (corr.), after drying at 100° , and containing two methoxyl groups and a hydroxyl group.

A crystalline *N*-methyl derivative of cephaline, melting at 194° (corr.), has also been obtained.

The results are being elaborated and extended, and it is hoped to communicate them fully to the Society later in the year.

203. "Dibenzoyldiaminoacetic acid."

By Paul Haas.

When α -hydroxyhippuric acid, $C_6H_5 \cdot CO \cdot NH \cdot CH(OH) \cdot CO_2H$, is heated to 150° , it is converted into dibenzoyldiaminoacetic acid, $(C_6H_5 \cdot CO \cdot NH)_2CH \cdot CO_2H$, in a 40 per cent. yield; the latter substance, on hydrolysis, decomposes into benzamide and glyoxylic acid.

204. "The so-called calcium β -diglycerolphosphate: A correction."

By Frank Tutin.

In a paper published by the present author and Mr. Hann (T., 1906, **89**, 1754), a calcium salt, melting at 249 — 250° , was described, which, on hydrolysis with dilute acids, gave a small yield of β -glycerolphosphoric acid. Analyses of the calcium salt mentioned gave results in harmony with the conclusion that it had the composition $C_{12}H_{28}O_{16}P_2Ca$, provided it were assumed that thirteen molecules of water of crystallisation were also present. It was therefore regarded as hydrated calcium β -diglycerolphosphate.

It has now been ascertained that this conclusion cannot be correct, since the calcium salt in question contains chlorine (about 38 per cent. on the air-dried material). This fact, however, does not affect the identity of the β -glycerolphosphoric acid prepared by the hydrolysis of the calcium salt, the formation of which was one of the objects of the above-mentioned investigation.

205. "Some derivatives of desylamine."

By Alex. McKenzie and Fred Barrow.

The authors have studied the conversion of phenylaminoacetic acid into desylamine, with the primary object of aiding an investigation, which is at present in progress, on the isolation of the optically active modifications of the base.

α -Phthalyliminophenylacetyl chloride, when acted on by benzene and aluminium chloride, gave desylphthalimide (compare Pfachler, *Ber.*, 1913, **46**, 1700), from which desylamine can be obtained.

A mixture of desylphthalimide and dibenzoylstilbene was produced by the interaction of desyl chloride and potassium phthalimide in presence of nitrobenzene at 150 — 160° .

2:4:5-Triphenyloxazole was prepared by the dehydration of benzodesylamide with concentrated sulphuric acid.

The action of various Grignard reagents on desylamine hydrochloride has also been investigated.

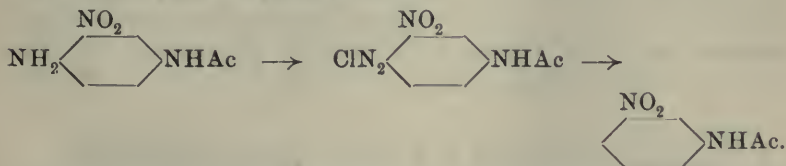
206. "Influence of substitution on the reactivity of *p*-phenylenediamine." By Gilbert T. Morgan and Joseph Allen Pickard.

This investigation, which is a contribution to the study of the inhibition of chemical change, was initiated with the object of ascertaining the part played by substituents in modifying the reactivity of *p*-phenylenediamine and its homologues. The following preliminary experiments were carried out on two derivatives of this diamine containing negative substituents.

*I.—The Reactivity of Nitro-*p*-phenylenediamine.*

1. *Acetylation*.—One acetyl group only was introduced into the molecule of this nitrodiamine by suspending the base in water, adding excess of acetic anhydride, and subsequently heating to boiling. The product, which crystallised from water in light red, felted needles, melting at 189°, was identical with the monoacetyl derivative previously obtained by half hydrolysing nitrodiacetyl-*p*-phenylenediamine with ammonia, dilute aqueous alkalis, or preferably with baryta water (*Ber.*, 1884, **17**, 148; 1886, **19**, 339; 1897, **30**, 980; 1903, **36**, 415).

As the constitution of this compound has been assumed without proof, it was dissolved in cold alcohol and treated successively with hydrogen chloride and nitrous fumes, the diazonium chloride being precipitated with dry ether. This salt was suspended in absolute alcohol, the mixture warmed with copper powder, and the solution neutralised with calcium carbonate, filtered, and evaporated nearly to dryness. *m*-Nitroacetanilide (m. p. 150°) separated, and was further identified by hydrolysis to *m*-nitroaniline (m. p. 112°). These reactions fix the constitution of the acetyl derivative as 2-nitro-4-acetyl-*p*-phenylenediamine,



Acetylation with acetic anhydride in the presence of water leads to diacetyl derivatives with *p*-phenylenediamine and its homologue,

2:5-tolylenediamine; it is also practicable with *m*- and *p*-nitroanilines, but not with *o*-nitroaniline.

2. *Picrylation*.—Only one picryl group is introduced by boiling nitro-*p*-phenylenediamine for twelve hours with excess of picryl chloride (3 mols.) in dry toluene over anhydrous sodium acetate.

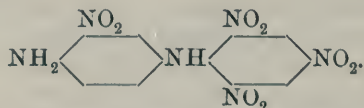
Nitro-4-picryl-p-phenylenediamine, which separated in dark red crystals melting at 255°, dissolved in aqueous or alcoholic sodium hydroxide, and was only sparingly soluble in alcohol, glacial acetic acid, or concentrated hydrochloric acid:

0.2028 gave 39.1 c.c. N_2 at 15° and 766 mm. $N = 22.77$.

$C_{12}H_8O_8N_6$ requires $N = 23.10$ per cent.

Comparative experiments with *o*-nitroaniline and 2:4-dinitroaniline showed that these bases are not picrylated under the foregoing conditions, and it is accordingly highly probable that in nitro-*p*-phenylenediamine picrylation occurs in the amino-group remote from the nitro-radicle. Direct evidence was obtained by dissolving the picryl derivative in concentrated sulphuric acid and adding successively to the bright yellow solution nitrosyl sulphate and alcohol, the temperature being kept below 5°. The solution of diazonium sulphate thus produced gave a deep red azo- β -naphthol derivative, dissolving in concentrated sulphuric acid to a bluish-green solution.

When boiled with copper powder, the alcoholic solution of the diazonium salt evolved nitrogen, and yielded picryl-*m*-nitroaniline (m. p. 207°), thus indicating the following constitution for the picrylated diamine:



3. *Diazotisation*.—Although nitro-*p*-phenylenediamine diazotises most readily to the monodiazonium salt (Bülow, *Ber.*, 1896, **29**, 2285) in 50 per cent. sulphuric acid, the second amino-group is attacked, with the production of the bisdiazonium sulphate. These reactions have been turned to account in the preparation of 4-nitro-*m*-toluidine. The homologous base, 4-nitro-2:5-tolylenediamine, behaved in a similar manner, diazotising chiefly to 4-nitro-5-amino-toluene-2-diazonium chloride with a smaller proportion of 4-nitro-toluene-2:5-bisdiazonium chloride.

II.—The Reactivity of 2:6-Dichloro-*p*-phenylenediamine.

1. *Acetylation*.—When boiled with acetyl chloride, 2:6-dichloro-*p*-phenylenediamine yielded 2:6-dichlorodiacetyl-*p*-phenylenedi-

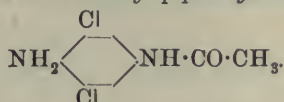
amine, which crystallised from alcohol or hot water in colourless needles, melting at 253—254°:

0.1722 gave 15.4 c.c. N_2 at 12° and 757 mm. $N=10.5$.

$C_{10}H_{10}O_2N_2Cl_2$ requires $N=10.73$ per cent.

When boiled for fifteen minutes with *N*-sodium hydroxide solution (30 parts), the diacetyl derivative yielded a monoacetyl compound, crystallising from alcohol in lustrous, colourless plates, melting at 218°, and dissolving in dilute hydrochloric acid, the soluble hydrochloride being readily diazotised.

2: 6-Dichloro-4-acetyl-*p*-phenylenediamine,



This isomeric monoacetyl derivative was produced by shaking 2: 6-dichloro-*p*-phenylenediamine with excess of acetic anhydride and water. It crystallised from alcohol or water in colourless needles, melting at 200°:

0.1553 gave 17.3 c.c. N_2 at 18° and 759 mm. $N=12.85$.

$C_8H_5ON_2Cl_2$ requires $N=12.70$ per cent.

The constitution of this compound was determined by adding nitrosyl sulphate to its slightly warm solution in absolute alcohol. The diazonium sulphate, which separated in colourless, feathery needles, was suspended in alcohol and treated with copper powder, when a brisk evolution of nitrogen occurred. 3: 5-Dichloroacetanilide (m. p. 187°) separated in colourless crystals on diluting the filtered solution with water, and this product, when hydrolysed with concentrated hydrochloric acid, yielded 3: 5-dichloroaniline (m. p. 51°).

2. *Picrylation*.—Only one amino-group is picrylated on boiling 2: 6-dichloro-*p*-phenylenediamine with picryl chloride in toluene solution over anhydrous sodium acetate.

2: 6-Dichloropicryl-*p*-phenylenediamine,



separated from glacial acetic acid in lustrous, dark red crystals, sintering at 220°, and melting at 227—228°:

0.1516 gave 0.1119 AgCl. $Cl=18.25$.

$C_{12}H_7O_7N_5Cl_2$ requires $Cl=18.27$ per cent.

The compound was soluble in aqueous or alcoholic alkali hydroxides, but dissolved only very sparingly in hydrochloric acid.

3. *Diazotisation*.—2: 6-Dichloro-*p*-phenylenediamine did not diazotise smoothly in aqueous solutions of the mineral acids, and

although the reaction proceeded more readily in alcoholic or glacial acetic acid solution, even then only one amino-group was diazotised with the formation of 2:6-dichloro-1-aminobenzene-4-diazonium chloride or sulphate. On treatment with absolute alcohol and copper powder, these diazonium salts yielded 2:6-dichloroaniline, thus showing that the amino-group diazotised is the one in the meta-position with respect to the chlorine atoms.

Summary.

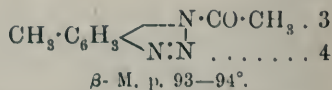
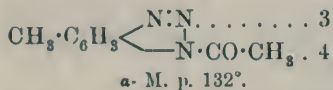
1. The introduction of a negative radicle into the aromatic nucleus of *p*-phenylenediamine hinders very considerably the acetylation of the amino-group contiguous to this substituent. The picrylation of this amino-group is completely inhibited.

2. The introduction of one nitro-group into the *p*-phenylenediamine or 2:5-tolylenediamine nucleus diminishes very considerably the diazotisability of the contiguous amino-group. The presence of two chlorine atoms in ortho-positions with respect to one amino-group of *p*-phenylenediamine inhibits completely the diazotisation of this group.

207. "The constitution of the ortho-diazoimines. Part III. The α - and β -acyl-3:4-tolylenediazoimides as structural isomerides." By Gilbert T. Morgan and Frances Mary Gore Micklethwait.

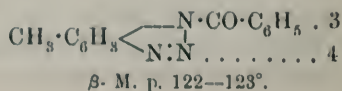
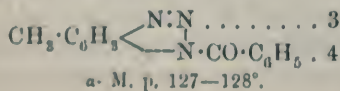
3:4-Tolylenediazoimine or its metallic derivatives yield on acetylation a mixture of two acetyl derivatives, which have hitherto been regarded as "physical isomerides" (Zincke and Lawson, *Annalen*, 1887, **240**, 119).

The authors have shown that these compounds are structural isomerides having the constitutional formulæ:



arising respectively as sole products of the diazotisation of 4-acetyl-3:4-tolylenediamine and 3-acetyl-3:4-tolylenediamine.

The chemical nature of the foregoing case of isomerism was confirmed by obtaining, from 4-benzoyl-3:4-tolylenediamine and 3-benzoyl-3:4-tolylenediamine respectively, the isomeric pair of benzoyl-3:4-tolylenediazoimides having constitutions represented by the following formulæ:



The existence of these two pairs of isomerides affords additional confirmation of Kekulé's formula for diazoimines as opposed to the configuration for these diazo-derivatives advocated by Griess.

208. "The occurrence of neon in vacuum-tubes containing hydrogen."
By Irvine Masson.

Experiments are in progress to test further the results of Collie and Patterson (T., 1913, **103**, 419), and have yielded independent evidence of the fact that neon appears after the passage of an electrical discharge through a vessel containing a gas previously free from neon.

When pure dry hydrogen was sparked in a discharge-tube bearing a perforated aluminium disk cathode and having a vacuous jacket surrounding it, it was found that after a time neon ceased to be formed; on then admitting a mixture of oxygen and hydrogen and passing the discharge, the tube appeared to be rendered "active" once more, for thereafter neon was steadily produced when hydrogen was sparked.

In all these experiments, hydrogen accumulated in the initially vacuous jacket, and had apparently passed through from the discharge-tube. Quantities up to about one-third of a c.c. could be so obtained. This gas was found to contain no other, except carbon monoxide in small and varying amounts.

209. "A simple and efficient method of dehydrating substances by electrical heating in a vacuum." By William Ernest Stephen Turner and Crellyn Colgrave Bissett.

Methods of electrical heating within a vacuum desiccator have already been described by Skita (*Chem. Zeit.*, 1902, **26**, 898) and by Scheermesser (*ibid.*, 1903, **27**, 175). The first-named author used two 16-candle-power lamps promoting a temperature of 70°; the second, a plate; and both methods are suitable more for the evaporation of liquids than for dehydration at higher temperatures.

The authors' own method, which was in use some time before they were aware of previous arrangements, is not only much more efficient, but also far simpler. It consists in introducing into a vacuum desiccator a heating coil made of manganin wire, a length of 90 cm. of No. 20 wire gauge being very suitable, so as to give a coil of about 4 cm. internal diameter. A cover for the coil is made by wrapping round it a strip of asbestos paper, previously moistened. Connexion is made with the coil by two leads of stout copper wire, which pass through two pieces of narrow quill glass

tubes inserted in the rubber stopper of the desiccator, the upper ends of the glass tubes being then closed by sealing wax.

Using a small platinum dish, weighing 12 grams, 3.5 grams of powdered silica were maintained in the exhausted desiccator at a temperature of 36° with a current of 2 amperes, 92° with 4 amperes, and 154° with 5.8. Still higher temperatures may be reached if desired. The drying agent used in the desiccator is phosphoric oxide.

The value of the method will be realised by the two following cases, in which dehydration by previous methods appears to have been both difficult and not entirely successful.

Lithium iodide at the ordinary temperature occurs as the trihydrate, although the commercial samples are usually partly dehydrated. In Abegg's "Handbuch der anorganischen Chemie," Vol. II, p. 130, it is stated that the anhydrous form may be produced by heating above 300° , but that the substance so obtained is not pure, since at this temperature it attacks glass and porcelain. From the authors' tests, a sample of the salt of composition corresponding precisely with the monohydrate did not lose moisture by standing over phosphoric oxide in an exhausted desiccator for three weeks. By the new process, pure anhydrous lithium iodide (Found, $I=94.9$. Calc., $I=94.8$ per cent.) was obtained after raising the temperature to about 100° for several hours. The iodide so obtained is quite white.

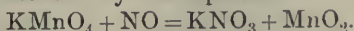
Rhamnose is another substance the dehydration of which up to now has proved very difficult. It occurs ordinarily combined with one molecule of water, and its dehydration not only requires prolonged heating on a water-bath, but the process is also accompanied by at least a partial conversion into the β -form. Purdie and Young (T., 1906, 89, 1194) state that dehydration is incomplete after prolonged heating at 70 — 90° under diminished pressure and in presence of phosphoric oxide, and is accompanied in this case also by partial conversion into the β -form. The authors have been successful in completely dehydrating rhamnose during the course of a week by raising the temperature within the exhausted desiccator very slowly to about 90° . Moreover, polarimetric observations (made by Mr. C. R. Young) point to the absence of the β -form from the dehydrated sugar.

210. "The vapour density of ammonium nitrate, benzoate, and acetate." By Prafulla Chandra Rây and Sarat Chandra Jana.

A detailed description of work of which a preliminary account has already appeared (this vol., p. 28).

- 211 "The action of nitric oxide on a neutral solution of potassium permanganate." By Barum Chandra Dutt, Bamacharan Chatterji, and Haridas Banerji.

When nitric oxide is passed through a solution of potassium permanganate in an atmosphere of hydrogen, the reaction which takes place is represented by the equation:



There is no intermediate formation of nitrous acid.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

[Beale, *Sir William Phipson*.] "On the utilization of sewage by phosphate of alumina," "Some further observations on the analysis of water," and "Primeval chemistry." ["B" Club Rhymes, 1867, etc.] (*Reference.*)

[Brough, *John Cargill*.] "Modern chemistry." ["B" Club Rhyme, 1868.] (*Reference.*)

[Field, *Frederick*.] "C. B," and "A quiet sort of way." ["B" Club Rhymes.] (*Reference.*) From Sir William Tilden, F.R.S.

Haas, *Paul*, and Hill, *T. G.* An introduction to the chemistry of plant products. London 1913. pp. xii + 401. 7s. 6d. net. (*Recd.* 16/6/13.) From the Publishers: Messrs. Longmans, Green and Co.

Heredia, *Carlos E.* Observaciones sobre el método crioscópico y relaciones entre los cuerpos simples. Buenos Aires 1912. pp. 244. (*Recd.* 5/6/13.) From the Author.

II. *By Purchase.*

Boyle, *Robert*. Memoirs for the natural history of Humane Blood, Especially the Spirit of that Liquor. London 1684. pp. [xvi] + 289 + [vii]. (*Reference.*)

Browning, *Philip E.* Introduction to the rarer elements. 3rd edition. New York 1912. pp. xii + 232. 6s. 6d. net. (*Recd.* 12/6/13.)

Loschmidt, *Joseph*. Konstitutions-Formeln der organischen Chemie in graphischer Darstellung. Edited by *Richard Anschütz*. (*Ostwald's Klassiker*, No. 190.) Leipzig. pp. 154. M. 5.—. (*Recd.* 19/6/13.)

Matthews, *J. Merritt*. The textile fibres: their physical, microscopical and chemical properties. 3rd edition. New York 1913. pp. xi + 630. ill. 17s. net. (*Recd.* 12/6/13.)

Neubauer, Carl Theodor Ludwig, and Huppert, Karl Hugo. Analyse des Harns. 11th edition. 2nd half. Wiesbaden 1913. pp. xxi+683 to 1657. ill. M. 27.—. (*Recd.* 13/6/13.)

Scheele, Karl Wilhelm. The chemical essays of . . . Translated from the Transactions of the Academy of Sciences at Stockholm. First published . . . in 1786. [Re-issued] with a sketch of the life of Karl Wilhelm Scheele by *John Geddes M'Intosh*. London 1901. pp. xxx+294. 5s. (*Recd.* 17/6/13.)

Scheithauer, W. Shale oils and tars, and their products. Translated by *Charles Salter*. London 1913. pp. viii+183. ill. 8s. 6d. net. (*Recd.* 15/6/13.)

Thresh, John C. The examination of waters and water supplies. 2nd edition. London 1913. pp. xx+644. ill. 18s. 0d. net. (*Recd.* 12/6/13.)

III. Pamphlets.

Butterfield, William John Atkinson. Lectures on chemistry in gas-works. pp. 71. London 1913.

Egypt. Survey Department. Report on the work of the Laboratories and of the Assay Office during 1912. By *Alfred Lucas*. pp. 28. Cairo 1913.

Hatton, John. Notes on the therapeutics of radium in the Bath waters. [Bath 1913.]

Hill, Charles Alexander. Lecture on the function and scope of the chemist in a pharmaceutical works. pp. 43. London 1913.

Metropolitan Water Board. Ninth research report. By *Alexander Cruikshank Houston*. pp. 26. London 1913.

Osterhout, W. J. V. Plants which require sodium. (From the *Bot. Gaz.*, 1912, 54.)

Parnas, Jakob. Ueber Bildung von Glykogen aus Glyzerinaldehyd in der Leber. (From the *Zentr. Physiol.*, 1912, 26.)

Ruttan, Robert F., and Hardisty, R. H. M. A new reagent for detecting occult blood. (From the *Canadian Med. Assoc. J.*, 1912.)

West Indies, Imperial Department of Agriculture. Sugar-cane experiments in the Leeward Islands. pp. 111. Barbados 1913.

THE LIBRARY.

The Library will be closed for Stocktaking from **Monday, August 11th, until Saturday, August 23rd, 1913, inclusive.**

Fellows are particularly requested to return all Library Books in their possession not later than **Wednesday, August 6th.**

LIST OF FELLOWS, 1913.

The List of Fellows for 1913 is now in active preparation, and changes of address **received after July 31st** cannot be included in it.

In order that the new List may be as complete as possible, those Fellows whose degrees and Christian names do not appear in full are requested to communicate them to the Assistant Secretary.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 29.

No. 419.

THE Council has ordered the following letter and report to be printed in the Journal and Proceedings of the Society:

WHINFIELD,
SALCOMBE,
S. DEVON.
Sept. 16th, 1913.

GENTLEMEN,

I have the honour to forward the Annual Report of the International Committee on Atomic Weights for 1914, which is submitted for publication in the Society's Transactions and Proceedings, as hitherto.

The Report deals with all the determinations of atomic weights which have been published since the issue of the preceding Report, but, in accordance with the resolution passed at the Eighth International Congress of Applied Chemistry, it is not proposed to make any change in the official table of atomic weights until the meeting of the next Congress in 1915.

Apart from this, the work of the past year has not shown any necessity for any addition to the existing list of Atomic Weights, or for any substantial alteration in the values last published.

It is accordingly recommended that the table accompanying the Report for 1913 should be reprinted as it stands.

I have appended the signatures of Professors Ostwald and Urbain as desired by them.

I am, Gentlemen,
Your obedient Servant,
T. E. THORPE.

*The Hon. Secretaries,
The Chemical Society,
London.*

Annual Report of the International Committee on Atomic Weights, 1914.

At the Eighth International Congress of Applied Chemistry, held in New York in September, 1912, a resolution was passed favouring less frequent changes in the official table of atomic weights. Such changes are sometimes embarrassing to technical chemists, and the resolution adopted expressed a desire that the table for 1913 should remain, for legal and commercial use, the official table until the next Congress convenes, in 1915. With this wish the Committee can easily comply; at least, in its essential features, for changes which affect the industrial chemist are not likely to be important, and the text of each annual report will give all the refinements of data which may be needed in theoretical discussions. Only such changes in the table as seem to be absolutely necessary need be made during the next two years, and that they should seriously affect the values in common use is highly improbable.

Since the annual report for 1913 was prepared, a number of important memoirs on atomic weights have appeared, which may be summarised as follows:

Nitrogen.—Schuer (Anzeiger Wien Akad., 1912, 49, 36), from analyses of nitrogen trioxide and tetroxide, and from measurements of ratios connecting the oxides of nitrogen, finds $N=14.008$ as the mean of five series of determinations. He also determined the densities of ammonia and of sulphur dioxide, obtaining results in accordance with earlier investigations. The value assigned to N varies from the rounded-off figure given in the table by only one part in 7000.

Chlorine.—By the synthesis of NOCl , by the direct union of nitric oxide and chloride, Wourtsel (*Compt. rend.*, 1912, 155, 345) finds $\text{Cl}=35.4596$, when $N=14.008$. He also (*Compt. rend.*, 1912, 155, 152) determined the density of nitrosyl chloride, and found the weight of the normal litre to be 2.9919 grams. From this he deduced a molecular weight of 65.456, which is probably too low. From the ratio between ammonia and hydrochloric acid, re-measured

by Baume and Perrot (*Compt. rend.*, 1912, **155**, 461), the authors found $\text{Cl}=35.463$, an unusually high value. None of these new determinations warrants any change in the accepted figure for chlorine.

Bromine.—By the direct synthesis of hydrobromic acid from weighed quantities of hydrogen and bromine, Weber (*J. Amer. Chem. Soc.*, 1912, **34**, 1294) finds $\text{Br}=79.3066$ when $\text{H}=1$. With $\text{O}=16$, the value for bromine becomes 79.924 . The accepted value differs from this by only 1 part in 20,000.

Phosphorus.—Baxter and Moore (*J. Amer. Chem. Soc.*, 1912, **34**, 1644), from analyses of phosphorus trichloride, find $\text{P}=31.018$, in good agreement with previous determinations. This is slightly lower than the value given in the table.

Iron.—By the reduction of ferric oxide in hydrogen, Baxter and Hoover (*J. Amer. Chem. Soc.*, 1912, **34**, 1657) find $\text{Fe}=55.847$.

Cadmium.—The electrochemical equivalent of cadmium has been determined by Laird and Hulett (*Trans. Amer. Electrochem. Soc.*, **22**, 385), who precipitated cadmium and silver simultaneously in an electric current. From the data given, the atomic weight of cadmium is 112.31 , a low value, but one in accord with the previous work of Hulett and Perdue on cadmium sulphate. The investigation is to be continued with the chloride.

Tellurium.—The supposed complexity of tellurium has been re-investigated by Dudley and Bowers (*J. Amer. Chem. Soc.*, 1913, **35**, 875), with negative results. They attempted to determine the atomic weight by the basic nitrate method, which they found to be unsatisfactory. A series of syntheses of the tetrabromide gave $\text{Te}=127.479$.

Uranium.—From calcinations of uranyl nitrate to uranium dioxide, Lebeau (*Compt. rend.*, 1912, **155**, 161) found $\text{U}=238.54$. Œchsner de Coninck (*Compt. rend.*, 1912, **155**, 1511), by calcination of uranic oxalate, obtained variable results, in mean, $\text{U}=238.44$.

Scandium.—Atomic weight redetermined by Meyer and Goldenberg (*Chem. News*, 1913, **106**, 12), who employed the sulphate method. In mean, $\text{Sc}=44.14$, in agreement with the accepted value. The higher figure given by Meyer and Winter was due to the presence of thoria in the material employed.

Yttrium.—Two determinations of the atomic weight by Meyer and Wuorinen (*Zeitsch. anorg. Chem.*, 1913, **80**, 7) gave $\text{Yt}=88.6$. The sulphate method was used. Egan and Balke (*J. Amer. Chem. Soc.*, 1913, **35**, 365), in a preliminary study of the ratio between yttrium chloride and yttria, found $\text{Yt}=90.12$. As their research is to be continued, it would be unwise to use either of these investigations as a basis for changing the table. The lower of the two values appears to be the more probable.

Ruthenium.—Vogt (*Sitzungsber. phys. med. Soz. Erlangen*, **43**, 268), from reductions of ruthenium dioxide, finds $Ru = 101.63$.

Palladium.—Determinations of atomic weight by analysis of palladiumammonium chloride have been made by Shinn (*J. Amer. Chem. Soc.*, 1912, **34**, 1448). The mean value obtained was $Pd = 106.709$, but the individual determination varied more than is satisfactory. Shinn supposes that the chloride is less definite than it has been assumed to be.

Radium.—From analyses of radium bromide, Hönigschmid (*Monatsh.*, 1913, **34**, 283) finds $Ra = 225.97$, in confirmation of his former analysis of the chloride. The discordance between this value and the higher value obtained by others is unexplained. The presumption is in favour of Hönigschmid's determination, but a change in the table may well be deferred until more evidence is available.

The following table is that of 1913, unchanged.

(Signed) F. W. CLARKE.
W. OSTWALD.
T. E. THORPE.
G. URBAIN.

1914.

International Atomic Weights.

O = 16.			O = 16.		
Aluminium	Al	27·1	Molybdenum	Mo	96 0
Antimony.....	Sb	120·2	Neodymium.....	Nd	144·3
Argon	A	39·88	Neon.....	Ne	20·2
Arsenic	As	74·96	Nickel	Ni	58·68
Barium.....	Ba	137·37	Niton (radium emanation) Nt		222·4
Bismuth	Bi	208·0	Nitrogen	N	14·01
Boron	B	11·0	Osmium	Os	190·9
Bromine	Br	79·92	Oxygen.....	O	16·00
Cadmium	Cd	112·40	Palladium.....	Pd	106·7
Cæsium.....	Cs	132·81	Phosphorus	P	31·04
Calcium	Ca	40·07	Platinum	Pt	195·2
Carbon	C	12·00	Potassium.....	K	39·10
Cerium.....	Ce	140·25	Praseodymium.....	Pr	140·6
Chlorine	Cl	35·46	Radium.....	Ra	226·4
Chromium	Cr	52·0	Rhodium	Rh	102·9
Cobalt	Co	58·97	Rubidium.....	Rb	85·45
Columbium	Cb	93·5	Ruthenium	Ru	101·7
Copper	Cu	63·57	Samarium	Sa	150·4
Dysprosium	Dy	162·5	Scandium.....	Sc	44·1
Erbium	Er	167·7	Selenium	Se	79·2
Europium.....	Eu	152·0	Silicon	Si	28·3
Fluorine	F	19·0	Silver	Ag	107·88
Gadolinium	Gd	157·3	Sodium	Na	23·00
Gallium	Ga	69·9	Strontium	Sr	87·63
Germanium	Ge	72·5	Sulphur	S	32·07
Glucium	Gl	9·1	Tantalum	Ta	181·5
Gold	Au	197·2	Tellurium	Te	127·5
Helium.....	He	3·99	Terbium	Tb	159·2
Holmium.....	Ho	163·5	Thallium	Tl	204·0
Hydrogen.....	H	1·008	Thorium	Th	232·4
Indium	In	114·8	Thulium	Tm	168·5
Iodine	I	126·92	Tin	Sn	119·0
Iridium.....	Ir	193·1	Titanium	Ti	48·1
Iron	Fe	55·84	Tungsten	W	184·0
Krypton	Kr	82·92	Uranium	U	238·5
Lanthanum	La	139 0	Vanadium	V	51·0
Lead	Pb	207·10	Xenon	Xe	130·2
Lithium	Li	6·94	Ytterbium (Neoytterbium) Yb		172·0
Lutecium ..	Lu	174·0	Yttrium	Yt	89·0
Magnesium	Mg	24·32	Zinc	Zn	65·37
Manganese	Mn	54·93	Zirconium.....	Zr	90·6
Mercury	Hg	200·6			

The following are abstracts of papers received during the vacation, and published, or passed for publication, in the *Transactions*:

212. "The viscosity of cellulose nitrate solutions."

By Frank Baker. (Trans., 1913, 1653.)

The viscosities of solutions in various solvents of different concentrations of cellulose nitrates have been determined. The relation $\gamma = \gamma_0(1+ac)k$ was found to express the connexion between the concentration of cellulose nitrate (c) and the viscosity. Comparison between the results obtained with different solvents suggests that the values of the constants a and k depend on the solvent power of the liquid for nitrocellulose.

The viscosity of solutions of nitrates of mercerised cellulose suggests that cellulose and mercerised cellulose are not identical, but that cellulose is degraded in the process of solution in ammoniacal copper oxide.

The influence of molecular attraction on physical properties is discussed, and association in liquids ascribed to increased molecular attraction.

213. "Geranyl chloride."

By Martin Onslow Forster and David Cardwell. (Trans., 1913, 1338.)

Geranyl chloride has been prepared by the action of thionyl chloride on a mixture of geraniol and pyridine, and appears to be identical with linalyl chloride; reasons are given for regarding the $C_{10}H_{17}$ -nucleus as being that of geraniol rather than the tertiary linalyl group. The *nitrosate*, $C_{10}H_{17}O_4N_2Cl$, melting at 101° , is a convenient derivative by which to identify geranyl chloride, which has a distinct odour of hops, and boils at $103^\circ/14$ mm.

The *hydrocarbon*, $C_{10}H_{16}$, produced along with geranyl chloride, boils at $174-176^\circ/763$ mm., and yields a *nitrosate*, melting at 131° , whilst the *hydrocarbon*, $C_{10}H_{18}$, prepared by reducing geranyl chloride, boils at $161^\circ/763$ mm., and yields a *nitrosate* melting at 95° . *Geranylamine*, $C_{10}H_{19}N$, boils at $105^\circ/19$ mm., and forms definite derivatives with the usual agents.

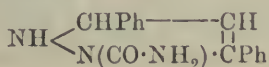
214. "A new method of preparing *m*-chlorobenzoic acid and the investigation of its hydroxylamine salt." By Wilhelm Glud and Richard Rempf. (Trans., 1913, 1630.)

m-Chlorobenzoic acid is prepared by heating benzoic acid with *aqua regia* on a water-bath, the chloro-acid being separated from

the crystalline mass by means of its calcium salt. The hydroxylamine salts of *m*-chlorobenzoic and benzoic acids were also prepared and examined, especially with reference to their solubility and their behaviour on heating. Both salts are easily converted into the corresponding ammonium salts, which readily dissociate into their components, the *m*-chlorobenzoate apparently more readily than the benzoate.

215. "Contributions to our knowledge of semicarbazones. Part III. Action of heat on the semicarbazones of phenyl styryl ketone and the preparation of the corresponding phenylsemicarbazones." By Isidor Morris Heilbron and Forsyth James Wilson. (Trans., 1913, 1504.)

The authors have investigated the action of heat on the phototropic semicarbazones derived from phenyl styryl ketone (compare T., 1912, 101, 1482). Both semicarbazones yielded, as main product, an isomeric compound melting at 189°, apparently cyclic in structure, for which the formula



is suggested.

The phenylsemicarbazones have also been investigated, having been prepared both directly by the interaction of phenyl styryl ketone and phenylsemicarbazide, and also by the action of boiling aniline on the original semicarbazones. The course of the latter action has been found to depend on the duration of the heating with aniline, prolonged heating producing from both semicarbazones a compound melting at 169°, and apparently, as deduced from spectrographic evidence, analogously constituted to the substance melting at 189°. On the other hand, five minutes' heating with aniline produces colourless phenylsemicarbazones, each semicarbazone yielding its respective phenyl derivative.

These phenylsemicarbazones are strongly phototropic, becoming intensely yellow in light, whilst their solutions show thermotropic properties. The action of sodium ethoxide on the phenylsemicarbazones produces the same effect as light, yellow stereoisomerides being formed.

Various attempts were made to hydrolyse the phenylsemicarbazones, but these only resulted either in a partial conversion of the one stereoisomeride into the other or in the formation of the cyclic compound melting at 189°.

216. "Contributions to the chemistry of the terpenes. Part XVI. The oxidation of bornylene with hydrogen peroxide." By George Gerald Henderson and William Caw. (Trans., 1913, 1543.)

Bornylene, in solution in acetic acid, is slowly oxidised by hydrogen peroxide, with the production of a mixture of free acids and esters. The acids were found to be (1) camphenanic acid, $C_9H_{15} \cdot CO_2H$ (m. p. 95°), (2) the isomeric *isocamphenanic* acid (m. p. 74°), and (3) a liquid *acid*, which, from the analysis of its *methyl* ester and *silver* salt, appears to have the formula $HO \cdot C_8H_{12} \cdot CO_2H$. When distilled under diminished pressure this liquid acid is converted into a crystalline unsaturated *acid* (m. p. 80°), which has not been further examined.

The mixture of esters was separated by steam distillation into a volatile and a non-volatile part. The former yielded on hydrolysis (1) acetic acid and, in much smaller quantity, the three acids already mentioned, and (2) a mixture of two alcohols of the formula $C_{10}H_{17} \cdot OH$. The alcohol present in largest quantity proved to be borneol, whilst the other was identified as *epiborneol*.

The non-volatile esters when hydrolysed gave (1) acetic acid with much smaller quantities of the other acids, and (2) a mixture of two isomeric *alcohols* of the formula $C_{10}H_{18}O_2$. These alcohols are crystalline solids, which melt at $247-248^\circ$ and $235-236^\circ$ respectively; the quantities hitherto obtained were not sufficient to permit of a satisfactory examination of these compounds.

The formation of camphenanic and *isocamphenanic* acids from bornylene is of particular interest, because these acids have already been obtained by oxidising camphene with hydrogen peroxide (compare T., 1911, 99, 1539). Thus further evidence is afforded of the very close similarity between the molecular structure of bornylene and that of camphene.

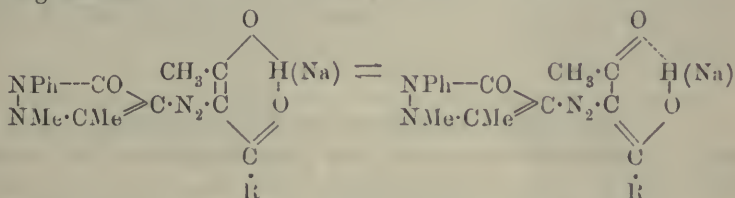
217. "The relative activities of certain organic iodo-compounds with sodium phenoxide in alcoholic solution. Part II. *iso*-, *sec*.- and *tert*.-alkyl iodides." By David Segaller. (Trans., 1913, 1421.)

The reactivities of *isobutyl*, *isoamyl*, *isopropyl*, *sec*.-butyl, *sec*.-amyl, *sec*.-hexyl, *sec*.-heptyl, *sec*.-octyl, *tert*.-butyl, and *tert*.-amyl iodides with sodium phenoxide in alcoholic solution have been measured. Allyl iodide was also included to give some indication of the effect of unsaturation. *iso*Compounds are much less reactive than the normal primary isomerides, whereas the normal secondary iodides are only slightly less reactive than the normal primary iodides. The reactivity decreases gradually with increase in molecular weight. The tertiary iodides are the most reactive of

the alkyl iodides, and yield olefines when treated with sodium phenoxide.

218. "Non-aromatic diazonium salts. Part II. Azo-derivatives from antipyrinediazonium salts and their absorption spectra." By Gilbert T. Morgan and Joseph Reilly. (Trans., 1913, 1494.)

The condensation products from antipyrinediazonium salts and acetylacetone, benzoylacetone and ethyl acetoacetate and the corresponding sodium derivatives exhibit very similar ultraviolet absorption spectra, their extinction curves being characterised by one persistent band comparable with the band shown by the β -diketones themselves and their metallic derivatives. It is therefore suggested that these condensation products and their sodium compounds are azo-derivatives, having the following co-ordinated configuration:



The corresponding azo- β -naphthylamine and its derivatives were also examined spectroscopically.

219. "The ten stereoisomeric tetrahydroquinaldinomethylenecamphors." By William Jackson Pope and John Reed (Trans., 1913, 1515.)

The *d*- and *l*-tetrahydroquinaldines condense with the *d*- and *l*-oxymethylenecamphors, yielding four simple optically active tetrahydroquinaldinomethylenecamphors; any two of these latter compounds are capable of combining together to form a stable solid double compound. There are thus obtainable four partly racemic and two fully racemic compounds.

The ten isomeric substances formed have been investigated, and, in spite of the facility with which the partly racemic compounds are produced, externally compensated tetrahydroquinaldine can be resolved by means of its condensation products with *d*-oxymethylenecamphor. The method of resolution is based on the fact that *d*-tetrahydroquinaldine condenses much less rapidly than *l*-tetrahydroquinaldine with *d*-oxymethylenecamphor.

220. "The isomerism of the oximes. Part I. The diphenylcarbamyl-oximes." By Oscar Lisle Brady and Frederick Percy Dunn. (Trans., 1913, 1613.)

A detailed description of work of which a preliminary account has already appeared (P., 1911, 27, 239).

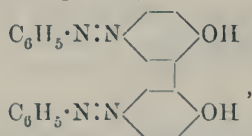
221. "The isomerism of the oximes. Part II. The nitrobenzaldoximes." By Oscar Lisle Brady and Frederick Percy Dunn. (Trans., 1913, 1619.)

The authors have investigated the action of sunlight on the nitrobenzantialdoximes, and have shown that in all cases they are converted into the corresponding *syn*-oximes. Hence Ciamician and Silber's statement that the meta-compound does not undergo this change is incorrect. It has also been shown that the *O*-methyl ethers of the nitrobenzantialdoximes are transformed into the *syn*-derivatives by the action of sunlight, but not so readily as are the oximes themselves. Experiments have also been made on the stability of the nitrobenzsynaldoximes.

222. "The azo-derivatives of 2:2'-diphenol."

By Philip Wilfred Robertson and Oscar Lisle Brady. (Trans., 1913, 1479.)

5:5'-Bisbenzeneazo-2:2'-diphenol,



exists in two modifications, yellow and red, both containing half a molecule of water of crystallisation, which is lost only at 160°, the colour of the compounds being unchanged after dehydration.

Several other derivatives have been obtained by the action of 2:2'-diphenol on various diazonium salts, although only the simple benzeneazo-compound has been found to exist in two forms. It has been noticed, however, that these compounds almost invariably separate with water of crystallisation, which is retained with unusual persistency, being driven off but slowly at 160°.

223. "The constitution of the trinitro-*p*-aminophenols and trinitro-*p*-anisidines." By Raphael Meldola and Frédéric Reverdin. (Trans., 1913, 1481.)

The trinitroacetylaminophenol described in 1906 (T., 89, 1935) is the 2:3:6-trinitro- and not the 2:3:5-trinitro-compound, as

appeared from the evidence formerly available. The trinitro-*p*-anisidine melting at 127—128° (*Arch. Sci. phys. nat.*, 1909, [iv], **27**, 383) has now been proved by direct evidence to be the 2:3:5-trinitro-compound, and the trinitroanisidine melting at 138—139° (T., 1910, **97**, 444) the 2:3:6-trinitro-compound. The position of the "mobile" nitro-group in the different series has been shown to be as formerly determined, namely, the 3-nitro-group in the 2:3:6-series, and in the 2:3:5-series the 2-nitro-group under the influence of bases, sodium acetate, etc., or the 3-nitro-group on diazotisation of the 4-amino-group (T., 1910, **97**, 1204).

224. "A new method for the determination of the concentration of hydroxyl ions. By Francis Francis and Frank Henry Geake. (Trans., 1913, 1722.)

The decomposition of nitrosotriacetoneamine into phorone, water, and nitrogen, under the influence of various bases has been fully investigated, the course of the reaction being followed by observing the volume of nitrogen evolved.

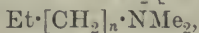
The rate of the reaction is proportional to the concentration of the hydroxyl ions, and the results show that, up to a concentration of 0.05*N*- and beyond 0.3*N*-hydroxyl ion, a new method has been found for the determination of the concentration of such ions. The utility of this method is indicated by the fact that the effect of neutral salts in moderate concentration on the course of the reaction appears to be negligible.

225. "The relation between residual affinity and chemical constitution. Part IV. Some open-chain compounds." By Hans Thacher Clarke. (Trans., 1913, 1689.)

Some measurements have been made of the reactivity of tertiary amines of the general formulæ $\text{Me}_2\text{N} \cdot [\text{CH}_2]_n \cdot \text{NMe}_2$ and



towards ethyl bromoacetate under standard conditions. It was found that the reactive power of the members of both series increases with increasing length of chain; furthermore, in both cases exaltation of reactivity was observed when the atoms of nitrogen and oxygen were situated in the critical positions ($n=3$ and 4). These results thus tend to confirm the hypothesis of "spatial conjugation" in open-chain compounds. In two control series of the general formulæ $\text{CHMe}_2 \cdot [\text{CH}_2]_n \cdot \text{NMe}_2$ and



only slight variations of reactive capacity were observed in the different members.

226. "The reduction of mercuric chloride by sodium formate." By Alexander Findlay and Morton James Pryce Davies. (Trans., 1913, 1550.)

The reduction of mercuric chloride by sodium formate has been studied kinetically at 40°. From the results it appears that the reaction is a bimolecular one, similarly to the reduction of mercuric chloride by phosphorous acid.

227. "The volatile constituents of coal. Part III." By Arthur Herbert Clark and Richard Vernon Wheeler. (Trans., 1913, 1701.)

Coal can be separated into two substances, differing widely in their characteristics, by the solvent action, first of pyridine and then of chloroform or benzene. The portion of coal soluble in pyridine appears to consist of the resinous constituents, together with some of the humus substances. The latter are insoluble in chloroform or benzene, whereas the resinous constituents are soluble. A separation can thus be made.

Destructive distillation at different temperatures of the separate portions of a bituminous coal obtained by use of these solvents supports the view already put forward (T., 1910, 97, 1924; 1911, 99, 649) that coal is conglomerated of two main types of substances, "hydrogen-yielding" and "paraffin-yielding," the former being the degradation products of the celluloses (humus substances), part of which are insoluble in pyridine, and part soluble in pyridine but insoluble in chloroform; and the latter being the resinous constituents, soluble in both pyridine and chloroform.

In an addendum to the paper [with CLAUDE BERNARD PLATT] attention is drawn to the results obtained by W. J. Russell (*Proc. Roy. Soc.*, 1908, B, 80, 432) when investigating the action of resin and allied substances on a photographic plate in the dark, and it is shown that the several portions into which coal can be separated by the solvents pyridine and chloroform affect a sensitised plate in different manners, the results supporting the conclusions drawn from the results of their destructive distillation.

228. "The volatile constituents of coal. Part IV. The relative inflammabilities of coal dusts." By Richard Vernon Wheeler. (Trans., 1913, 1715.)

If coal be regarded as a conglomerate of two main types of compounds, the one readily yielding inflammable gases and vapours on heating to a comparatively low temperature, the other requiring

a higher temperature of more prolonged duration to decompose it freely, it can be understood that variations in the proportions in which these different types exist in different coals should cause corresponding variations in the chemical and physical properties of the coals.

A property, common to all coals, which would appear to depend essentially on the proportion of readily-decomposed constituents present, is their "inflammability" when in the form of dust.

It is shown that for a number of coal dusts tested the relative inflammabilities varied directly with the relative proportions of readily-decomposed constituents in the coals.

229. "The methylation of cellulose."

By William Smith Denham and Hilda Woodhouse. (Trans., 1913, 1735.)

When alkali-cellulose, prepared by mixing cellulose with sufficient 15 per cent. solution of sodium hydroxide to give a mixture in which the proportions of the constituents are represented by the ratio $C_6H_{10}O_5 : 2NaOH$, is treated with excess of methyl sulphate a methylated cellulose is obtained, which retains the fibrous structure of the original material and has the composition represented by the empirical formula $C_{12}H_{19}O_9 \cdot OMe$. If this substance is subjected to a repetition of the same treatment the composition of the new product is given by the formula $C_6H_9O_4 \cdot OMe$, whilst another repetition of the process yields a substance the composition of which is given by the formula $C_{24}H_{35}O_{15}(OMe)_5$. All these substances can be acetylated, giving derivatives in which the methyl group is still present. The substance $C_6H_9O_4 \cdot OMe$ has been converted into a material which resembles viscose.

230. "The structure of the salts of nitrophenols." By John Theodore Hewitt, Rhoda Marianne Johnson, and Frank George Pope. (Trans., 1913, 1626.)

An attempt has been made to attack the problem of the constitution of the nitrophenolates on chemical grounds. The sodium derivatives of true phenols react in absolute alcoholic solution with ethyl chloroacetate at water-bath temperatures, giving ethyl aryloxyacetates. Even 2:4:6-tribromophenol is not sterically hindered, but *o*- and *p*-nitrophenols do not react under the conditions mentioned. Sodium *m*-nitrophenolate, however, gives a good yield of ethyl *m*-nitrophenoxyacetate.

The nitro-group in the nitrophenolates is evidently also affected;

whilst sodium methoxide reduces nitrobenzene to azoxybenzene and nitroanisole to azoxyanisole, the nitrophenols are not converted into azoxyphenols.

231. "The neutral and acid oxalates of potassium." By Harold Hartley, Julien Drugman, Charles Archibald Vlieland, and Robert Bourdillon. (Trans., 1913, 1747.)

A further study has been made of the equilibrium of the system potassium hydroxide-oxalic acid-water, confirming in the main the results of previous investigators, but explaining some discrepancies in their work, for example, the anomalous solubility curve of the neutral oxalate, the degree of hydration of potassium hydrogen oxalate, and the transition temperature of the two modifications of the latter salt. A crystallographic examination has been made of tetrapotassium dihydrogen oxalate, and of a twinned form of the neutral oxalate.

232. "Adiabatic and isothermal compressibilities of some liquids between one and two atmospheres pressure." By Daniel Tyrer. (Trans., 1913, 1675.)

A method is described by which the adiabatic compressibility of a liquid can be accurately determined at a pressure of 1 to 2 atmospheres. This consists in principle of compressing the liquid contained in a suitable vessel and observing directly the volume change which occurs, in a calibrated capillary tube. Measurements have been made over a temperature change of 0° to the boiling point for the following nine liquids: Ether, chloroform, carbon tetrachloride, benzene, toluene, chlorobenzene, carbon disulphide, ethyl alcohol, and water.

By aid of the following thermodynamic equation values have been obtained for the isothermal compressibility:

$$\beta = \alpha + \frac{T \left(\frac{dv}{dt} \right)^2}{JvC_p},$$

where β is the isothermal compressibility, α the adiabatic compressibility, T the temperature on the absolute scale, v is the specific volume, J the mechanical equivalent of heat, and C_p is the specific heat at constant pressure. The results are compared with the few results already determined by the direct method at low pressures, and a fairly good agreement is found.

233. "The constitution of aconitine."

By Oscar Lisle Brady. (Trans., 1913, 1821.)

A detailed description of work of which a preliminary account has already appeared (P., 1912, 28, 289).

234. "The methylation of quercetin."

By Arthur George Perkin. (Trans., 1913, 1632.)

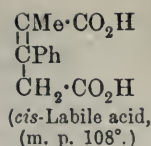
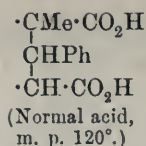
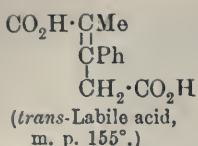
Although owing to the presence of an hydroxyl group adjacent to the carbonyl group it has not hitherto been considered possible fully to methylate quercetin by means of methyl iodide and alkali, no difficulty in reality exists in preparing a quantity of quercetin pentamethyl ether by this method, provided that an excess of the reagents is employed. This substance is to be found dissolved in the aqueous liquid obtained when the product of the reaction is diluted with water, and may be separated therefrom by treatment with salt. Small amounts of substances soluble in ether are simultaneously produced, namely, *methylquercetin tetramethyl ether*, $C_{20}H_{20}O_7$, yellow needles (m. p. 184—185°), which yields an *acetyl* derivative, $C_{20}H_{10}O_7Ac$, colourless needles (m. p. 178—180°), and a yellow *potassium* salt, decomposed by water, and *methylquercetin pentamethyl ether*, $C_{21}H_{22}O_7$, colourless needles (m. p. 213—215°). By hydrolysis the former gives methylphloroglucinol-monomethyl ether (T., 1900, 77, 1318) and veratric acid, whereas from the latter a substance considered to be *methoxymethylfisetol dimethyl ether*, colourless needles (m. p. 148—149°) (compare Herzig, Ber., 1909, 42, 155), and veratric acid are produced.

235 "The absorption spectra of various derivatives of aniline, phenol, and benzaldehyde." By John Edward Purvis. (Trans., 1913, 1638.)

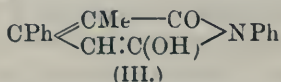
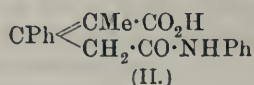
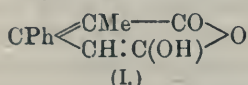
A comparative study has been made of the absorption spectra of the vapours and alcoholic solutions of *o*-, *m*-, and *p*-bromoaniline, *o*-, *m*-, and *p*-iodoaniline, 2:4-dichloroaniline, *p*-bromophenol, *p*-iodophenol, 2:4:6-trichlorophenol, 2:4:6-tribromophenol, *m*-aminophenol, *m*-dimethylaminophenol, *p*-aminobenzaldehyde, and *p*-dimethylaminobenzaldehyde.

236. "The chemistry of the glutaconic acids. Part VIII. β -Phenylglutaconic acid and the β -phenyl- α -methylglutaconic acids." By Jocelyn Field Thorpe and Arthur Samuel Wood. (Trans., 1913, 1569.)

β -Phenyl- α -methylglutaconic acid has been isolated in three distinct modifications, which can be represented by the following formulæ:



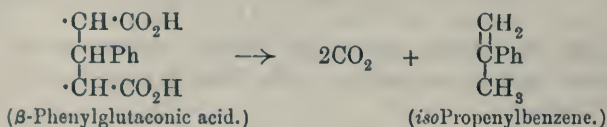
The *trans*-labile acid is stable towards acetyl chloride, but both the normal acid and the *cis*-labile acid are converted by this reagent into the hydroxy-anhydride (I) (m. p. 94°), which yields the anilic



acid (II) (m. p. 143°) and the hydroxy-anil (III) (m. p. 216°) with aniline.

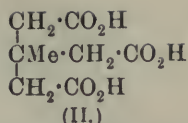
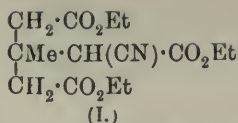
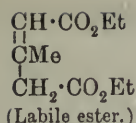
The *trans*-labile acid is converted into the sodium salt of the *cis*-labile acid by alkali hydroxide, and both the *cis*-labile acid and the *trans*-labile acid are converted into the normal acid by hydrochloric acid. The hydroxy-anhydride is converted into the normal acid by boiling water and into the *cis*-labile acid by alkali in the presence of casein. The three modifications of the acid are readily distinguished by the aid of their barium salts.

The acids of this type readily undergo decomposition when boiled with dilute mineral acids, and yield the corresponding hydrocarbon, thus:

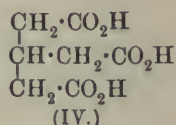
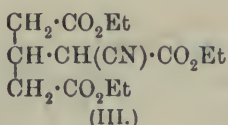
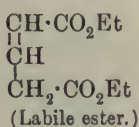
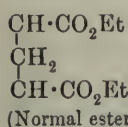


237. "The chemistry of the glutaconic acids. Part IX. A method for distinguishing between the esters of the normal and labile acids." By Jocelyn Field Thorpe and Arthur Samuel Wood. (Trans., 1913, 1579.)

The ester of a labile acid can be readily distinguished from its normal isomeride by the capacity it possesses of forming a condensation product with ethyl sodiocyanoacetate; thus the labile ethyl ester of β -methylglutaconic acid forms the condensation product (I) to the extent of 60 per cent., whereas the corresponding normal ester under similar conditions yields no trace of this substance:



The condensation product yields *ββ-dimethylpropanetricarboxylic acid* (II) on hydrolysis, and derivatives of this compound have been prepared. Several normal esters of the series were investigated, but were found to yield no trace of a condensation product. Normal ethyl glutaconate, which is capable of passing, with considerable ease, into derivatives of the unstable labile ester, yields with ethyl sodiocyanoacetate about 5 per cent. of the condensation product (III), from which *isobutane-αγγ'-tricarboxylic acid* (IV) can be isolated on hydrolysis:



238. "The chemistry of the glutaconic acids. Part X. The alkylations of the ethereal salts." By Jocelyn Field Thorpe and Arthur Samuel Wood. (Trans., 1913, 1752.)

The formation of alkyl derivatives from esters of the glutaconic acids is controlled by the following generalisations:

(1) The formation of the sodium derivative of an ester of a glutaconic acid, and hence the formation of an alkyl derivative, takes place through the labile form of the ester alone.

(2) The normal esters, as such, do not react with sodium ethoxide.

(3) The formation of a sodium derivative of a normal ester is therefore dependent on the tendency for the ester to pass into the labile modification under the experimental conditions employed.

(4) The formation of a sodium derivative from a normal ester of a monoalkylated dicarboxylic acid involves the passage of the mobile hydrogen atom to the carbonyl system not affected by the substituting group. The second alkyl group therefore enters on the carbon atom of the three-carbon system most remote from that bearing the existing alkyl group.

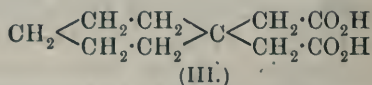
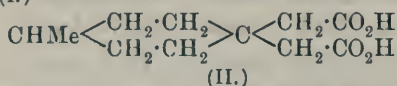
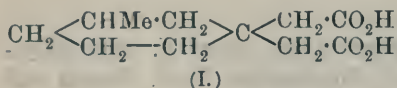
(5) Those esters which contain two or three potentially mobile hydrogen atoms can be made to yield dialkyl derivatives having the alkyl groups on the same carbon atom by alkylating them under conditions which prevent the passage of the labile monoalkyl derivative, which is first formed, into its normal isomeride. This

can be effected by the presence of excess of sodium ethoxide throughout the alkylation.

(6) Esters, although they may have the labile structure, will not react with sodium ethoxide if the nature of the groups carried by the carbon atoms of the three-carbon system is such as to prevent the movement of the hydrogen atom within the molecule.

239. "The formation and reactions of imino-compounds. Part XVIII. The condensation of *cyclohexanones* with cyanoacetamide involving the displacement of an alkyl group." By Jocelyn Field Thorpe and Arthur Samuel Wood. (Trans., 1913, 1586.)

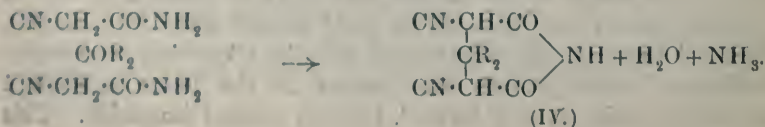
Whereas 3-methyl*cyclohexanone* and 4-methyl*cyclohexanone* yield condensation products with cyanoacetamide from which 3-methyl*cyclohexane-1:1-diacetic acid* (I) and 4-methyl*cyclohexane-1:1-diacetic acid* (II) can be prepared in large quantity, 2-methyl*cyclo-*



hexanone and 1:3-dimethyl*cyclohexane-4-one* condense with the amide to form *cyclohexane-1:1-diacetic acid* (III) and 4-methyl*cyclohexane-1:1-diacetic acid* (II) respectively.

Since great care was taken to use these ketones in a very pure form, it follows that the presence of the methyl group in the 2-position inhibits condensation, but that the tendency for the formation of a condensation product is so considerable that it is effected through the displacement of this group, probably as methyl alcohol.

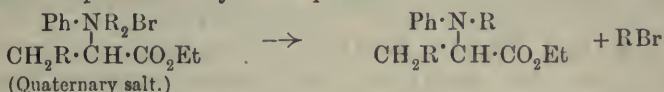
The by-products formed to the extent of about 10 per cent. in the reactions between the ketones and cyanoacetamide are the cyano-imides (IV) formed in accordance with the equation:



240. "The replacement of alkyl groups in tertiary aromatic bases."

By Jocelyn Field Thorpe and Arthur Samuel Wood. (Trans., 1913, 1601.)

Experiments are described showing the unsuitability of the bases diethyl- and dimethyl-aniline for the purpose of eliminating hydrogen haloid from substances capable of parting with these elements. It is shown, for example, that there is always a tendency for the base to combine with the halogen derivative, forming a quaternary salt, and that when once this salt is formed a decomposition represented by the equation



ensues on heating.

In the case of those substances which are not capable of eliminating hydrogen haloid, the formation of the quaternary salt and its decomposition in accordance with the equation

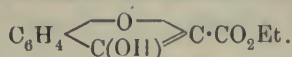


is quickly completed.

The reactions between the dialkylanilines and both trimethylene bromide and ethylene dibromide are also described.

241. "Coumaranone derivatives. Part II. The constitution of ethyl coumaranonecarboxylate." By Richard William Merriman, (Trans., 1913, 1838.)

Several distinct observations indicate that ethyl coumaranonecarboxylate normally exists in the enolic form



(a) During many subsequent attempts to prepare the phenylhydrazone described in Part I. (T., 1911, 99, 911), an isomeric substance, $\text{C}_6\text{H}_4 \begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{C}(\text{NH} \cdot \text{NHPh}) \end{array} \text{C} \cdot \text{CO}_2\text{Et}$, was always obtained.

(b) An oxime could not be isolated. (c) Exactly one equivalent of sodium hydroxide was required to neutralise the ester. (d) It reacts towards Grignard's reagent entirely in the enolic form. (e) The absorption curves of the ester and its acetyl derivative are practically identical. The addition of alkali completely alters the character of the absorption spectrum. This fact has been explained by the modification of Hantzsch's theory proposed by Brannigan, Macbeth, and Stewart (T., 1913, 103, 415).

o-Carbamylphenoxyacetic acid, $\text{NH}_2 \cdot \text{CO} \cdot \text{C}_6\text{H}_4 \cdot \text{O} \cdot \text{CH}_2 \cdot \text{CO}_2\text{H}$, was prepared during this investigation.

242. "Coumaranone derivatives. Part III. Acylazo-derivatives of coumaranonecarboxylic acid." By Richard William Merriman. (Trans., 1913, 1845.)

Benzeneazocarbonylcoumaranone, $\text{C}_6\text{H}_4 \begin{smallmatrix} \text{O} \\ \diagup \quad \diagdown \\ \text{C}(\text{OH}) \end{smallmatrix} \text{C} \cdot \text{CO} \cdot \text{N} \cdot \text{NPh}$,

and its phenylhydrazone, $\text{C}_6\text{H}_4 \begin{smallmatrix} \text{O} \\ \diagup \quad \diagdown \\ \text{C}(\text{N} \cdot \text{NHPh}) \end{smallmatrix} \text{CH} \cdot \text{CO} \cdot \text{N} \cdot \text{NPh}$ (Part I., T., 1911, 99, 911), have been subjected to further investigation, the results of which confirm the formulæ assigned to them.

An acetate and metallic derivatives of benzeneazocarbonylcoumaranone have been prepared. By reducing an alkaline solution of the orange azo-compound with zinc dust the colourless hydrazo-derivative, $\text{C}_6\text{H}_4 \begin{smallmatrix} \text{O} \\ \diagup \quad \diagdown \\ \text{CO} \end{smallmatrix} \text{CH} \cdot \text{CO} \cdot \text{NH} \cdot \text{NHPh}$, was obtained. When

stannous chloride or sodium hyposulphite was used as the reducing agent, the azo-group was broken, with the liberation of aniline.

The red azophenylhydrazone also forms an acetate and metallic derivatives. This phenylhydrazone is extremely resistant towards all hydrolytic agents, except fuming hydrobromic acid, which converts it into the parent azo-compound.

Similar colourless hydrazo-compounds, orange azo-compounds, and red hydrazones of the latter have been prepared by using the three tolylhydrazines in place of phenylhydrazine.

The absorption spectra of the above compounds have been measured and compared with those of *s*-benzoylphenylhydrazine, $\text{NHBz} \cdot \text{NHPh}$, and Fischer's benzoylazobenzene, $\text{NBz} \cdot \text{NPh}$.

243. "The dynamics of bleaching."
By Sydney Herbert Higgins. (Trans., 1913, 1816.)

Experiments on the bleaching of linen cloth containing a large excess of colouring matter, by means of very dilute bleaching powder solution, show that the bleaching action proceeds in accordance with the equation:



and is thus a unimolecular reaction.

The influence of adding lime-water or hydrochloric acid to the bleaching solution was also studied.

244. "Note on the structure of certain lactones formed by the fission of the *gem*-dimethylcyclopropane ring." By William Henry Perkin, jun., and Jocelyn Field Thorpe. (Trans., 1913, 1760.)

The constitution of the lactone-dicarboxylic acids *A* and *B* described in a former paper (T., 1901, 79, 764) and of lactone-dicarboxylic acids prepared by Baeyer (*Ber.*, 1896, 29, 2792) and by Aschan (*Annalen*, 1913, 398, 299) is discussed.

245. "The resolution of 2:3-diphenyl-2:3-dihydro-1:3:4-naphthaisotriazine into optically active components." By William Jackson Pope and Clara Millicent Taylor. (Trans., 1913, 1763.)

The resolution of this base is effected by crystallisation with *d*-bromocamphor- π -sulphonic acid; the fractional crystallisation of the mixed salt which results yields two salts of the optically active acid, containing the *d*- and the *l*-base respectively. The liberation of the optically active base from the salts is accompanied by its complete optical inversion.

246. "The mutual solubilities of ethyl acetate and water and the densities of mixtures of ethyl acetate and ethyl alcohol." By Richard William Merriman. (Trans., 1913, 1774.)

The mutual solubilities of ethyl acetate and water have been determined by a method which enables a test of the accuracy of the results to be applied. Although contraction occurs in the formation of both of the saturated solutions, yet the solubility of ethyl acetate in water increases with rise of temperature, but the solubility of water in ethyl acetate decreases with rise of temperature. There is no point of maximum density of water saturated with ethyl acetate above 0°.

When alcohol is mixed with ethyl acetate a small expansion takes place; the maximum percentage expansion occurs when the two liquids are approximately in equimolecular proportions. A table of densities of mixtures of the two liquids is given.

247. "The azeotropic mixtures of ethyl acetate, ethyl alcohol, and water at pressures above and below the atmospheric pressure. Part I." By Richard William Merriman. (Trans., 1913, 1790.)

The change in composition of the azeotropic mixture of ethyl acetate and water has been traced from 25 mm. to 1500 mm.

pressure. The percentage of water increases continuously with the pressure, and there is no evidence of a constant value being reached at higher pressures. Assuming that the expression

$$p_1/p_2 = x/(1-x),$$

where p_1 and p_2 are the partial pressures and x and $(1-x)$ are the molecular proportions of the two substances, holds for the azeotropic mixture, the partial pressure of the water has been calculated. At all temperatures this partial pressure is almost exactly equal to the vapour pressure of pure water at the same temperature. The Duhem-Regnault law, which states that in the case of partly miscible liquids the total pressure of the heterogeneous mixture is equal to the vapour pressure of the more volatile component in the pure condition, has been found to be erroneous.

248. "The azeotropic mixtures of ethyl acetate, ethyl alcohol, and water at pressures above and below the atmospheric pressure. Part II." By Richard William Merriman. (Trans., 1913, 1801.)

The alterations in composition of the ester-alcohol binary mixture and the ternary mixture have been studied at pressures ranging from 25 mm. to 1500 mm. There is no evidence of constant composition being attained at any pressure.

Although the vapour-pressure curves of ethyl alcohol and ethyl acetate cross at a pressure of 948 mm., yet the percentage of alcohol in the azeotropic mixture increases continuously with the pressure, and shows no break at the point of crossing of the vapour-pressure curves. The following general rule for the change of composition of a binary azeotropic mixture of minimum boiling point has been deduced from the present investigation: The percentage of the liquid, for which dp/dt is the smaller, increases as the pressure decreases. The rule is followed in seven different cases. The only exception that has been found is the ethyl alcohol-water mixture (Wade and Merriman, T., 1911, 99, 997).

249. "The mechanism of the condensation of glucose with acetone." By James Leslie Auld Macdonald.

Experience in the preparation of glucose-monoacetone and diacetone has shown that, however prolonged the treatment with acid acetone may be, glucose monoacetone may always be isolated at the end of the reaction, and, moreover, the two condensation products are obtained in very variable yields. The conclusion is drawn that the formation of these compounds does not depend on the hydrolysis of glucose dimethylacetal, followed by condensation in definite stages with two molecules of acetone.

By arresting the condensation of glucose dimethylacetal with acetone at an early stage, *glucose dimethylacetal- $\epsilon\zeta$ -monoacetone** has been isolated as the main initial product. This compound is highly unstable towards heat and acids, and readily loses methyl alcohol, with the formation of *methylglucoside- $\epsilon\zeta$ -monoacetone*. The position of the acetone residue in this compound was established by methylation by the silver oxide method, and subsequent hydrolysis of the product in two stages. In this way, *$\beta\gamma$ -dimethyl methylglucoside- $\epsilon\zeta$ -monoacetone*, *$\beta\gamma$ -dimethyl methylglucoside*, and lastly *$\beta\gamma$ -dimethyl glucose* were obtained.

On the other hand, prolonged treatment of glucose dimethylacetalmonoacetone with acid acetone results in simultaneous hydrolysis and condensation taking place, and the formation of glucose diacetone. The di-derivative thus produced has therefore the acetone residues linked to the two pairs of carbon atoms, $\alpha\beta$ and $\epsilon\zeta$ respectively, a conclusion which harmonises with all the evidence available regarding the structure of this compound.

The condensation reactions of glucose dimethylacetal are thus extremely complex. When left in contact with acetone containing hydrogen chloride the initial products are glucose monoacetone and glucose dimethylacetalmonoacetone, the latter compound probably furnishing the chief source of glucose diacetone.

250. "Condensation of acid chlorides with the ethyl esters of (a) cyanoacetic acid, (b) malonic acid, and (c) acetoacetic acid. Part I." By Charles Weizmann, Henry Stephen, and Ganesh Sakharam Agashe. (Trans., 1913, 1855.)

A detailed description of work of which a preliminary account has already appeared (P., 1912, 28, 103).

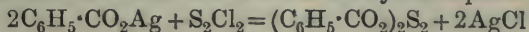
251. "2-Phenyl-5-styryloxazole."

By Robinson Percy Foulds and Robert Robinson. (Trans., 1913, 1768.)

In order to characterise 2-phenyl-5-styryloxazole the authors have prepared the substance by treating *styryl benzoylaminomethyl ketone* with concentrated sulphuric acid.

252. "The action of sulphur chloride and of thionyl chloride on metallic salts of organic acids: preparation of anhydrides." By William Smith Denham and Hilda Woodhouse. (Trans., 1913, 1861.)

The reaction between sulphur chloride and metallic salts of organic acids in the presence of an indifferent solvent, which is represented for the case of silver benzoate by the equation



* The nomenclature adopted is that used in T., 1913, 103, 564.

(T., 1909, 95, 1237), has been found to be general for many types of acids. Salts of hydroxy- and amino-acids behave exceptionally. The compounds of the type $(R \cdot CO_2)_2S_2$ are in all cases unstable, and decompose spontaneously with separation of sulphur and formation of sulphur dioxide and the anhydride of the acid. Under similar conditions thionyl chloride usually yields sulphur dioxide, the acid anhydride and the chloride of the metal (P., 1909, 25, 294), but in the case of hydroxy-acids intermediate compounds are formed, which, on loss of sulphur dioxide, give rise to anhydro-compounds. A crystalline *malic anhydride* has been prepared in this way.

The respective behaviours of sulphur chloride and thionyl chloride in these reactions are consistent with their possessing similar constitutions.

253. "The action of magnesium aryl haloids on glyoxal."

By Henry Wren and Charles James Still. (Trans., 1913, 1770.)

*iso*Hydrobenzoin, $\alpha\beta$ -*dihydroxy*- $\alpha\beta$ -*di-p-toly*lethane (m. p. 161.8—162.6°), and $\alpha\beta$ -*dihydroxy*- $\alpha\beta$ -*di-o-töly*lethane (m. p. 116.5—118°) have been prepared by the action of magnesium phenyl bromide, magnesium *p*-tolyl bromide, and magnesium *o*-tolyl bromide respectively on unimolecular glyoxal (Harries and Temme, *Ber.*, 1907, 40, 165). In no case could definite evidence of the formation of the second theoretically possible isomeride be obtained. The *acetyl* derivatives corresponding with the two latter glycols melt at 105—106° after softening at 103—104°, and 99—100° after softening at 98.5° respectively.

254. "The miscibility of solids. Part II. The influence of chemical constitution on the thermal properties of binary mixtures." By Ernest Vanstone. (Trans., 1913, 1826.)

The method of thermal analysis has been applied to binary mixtures of the type $Ph\alpha\beta Ph$.

Pascal and Normand (*Bull. Soc. chim.*, 1913, [iv], 13, 151, 201) have shown that dibenzyl, stilbene, tolane, azobenzene, and hydrazobenzene are miscible in all proportions in the solid state; also that with benzylaniline, benzylideneaniline, and phenyl benzyl ether eutectic diagrams are obtained, and solid-solution formation is limited.

A series of thermal diagrams for benzoin and benzil with these substances has been determined. In each case the diagram shows a single eutectic point and limited formation of solid solutions.

The eutectic point depends on the melting points of the con-

stituents. It is always found nearer the substance of lower melting point. The molecular volumes at the temperatures of their melting points of ten substances have been determined. Substances containing oxygen have the greatest molecular volumes.

The exceptional behaviour of benzil, when compared with other symmetrical compounds of the type $\text{Ph}\alpha\alpha\text{Ph}$, is discussed, and the greater molecular domain of benzil is suggested as the cause of its lower degree of miscibility.

255. "The solubilities of alkali haloids in methyl, ethyl, propyl, and isoamyl alcohols." By William Ernest Stephen Turner and Crellyn Colgrave Bissett.

The solubilities, in methyl, ethyl, propyl, and isoamyl alcohols, of lithium chloride and iodide, sodium chloride and iodide, potassium chloride, bromide and iodide, and rubidium chloride have been determined. Measurements were made at a common temperature of 25° , and in the case of lithium chloride in ethyl alcohol, also over the range from 0° to 60° .

The existence of the compound $\text{LiCl}\cdot 4\text{C}_2\text{H}_5\text{O}$, first indicated by Simon, was confirmed, and its transition point into lithium chloride fixed as 17.4° . A compound, $\text{LiI}\cdot 4\text{C}_3\text{H}_7\text{O}$, stable at 25° , was also found, and another, $\text{NaI}\cdot 3\text{CH}_3\text{O}$, stable at $15-16^{\circ}$.

The solubilities at 25° proved that solvent action, on the above salts, decreases continuously in passing from water through the series of alcohols; that the order of solubility is iodide > bromide > chloride; and that, in all the solvents, the solubility of the alkali chlorides is in the order: lithium chloride > sodium chloride > rubidium chloride > potassium chloride.

256. "Nitration of 1-chloro-2:4-dinitronaphthalene."

By Max Rindl.

A solution of 1-chloro-2:4-dinitronaphthalene in cold concentrated nitric acid deposits on keeping prismatic crystals of 1-chloro-2:4:5-trinitronaphthalene, melting at $143-144^{\circ}$. After several weeks 1-chloro-2:4:8-trinitronaphthalene begins to be deposited, along with the 1-chloro-2:4:5-trinitronaphthalene. The chlorine atom in both of these compounds is mobile. By treatment with aqueous solutions of alkali hydroxides they are converted into the corresponding trinitronaphthols. Only the 2:4:5-trinitro- α -naphthol can be reconverted into the corresponding chlorotrinitronaphthalene by means of *p*-toluenesulphonyl chloride and diethylaniline. Other reactions depending on the mobility of the chlorine atom

are the formation of 2:4:5-trinitro- α -naphthyl methyl ether and of amines, for example, 2:4:5-trinitro- α -naphthylamine, as well as mono- and di-substituted alkyl- and aryl-amines. Copper powder removes the chlorine, and two molecules join together, forming dinaphthyl derivatives. In the case of 1-chloro-2:4:5-trinitro-naphthalene a secondary reaction takes place, resulting in the elimination of chlorine and its replacement by hydrogen, with the formation of 1:3:8-trinitronaphthalene.

257. "The decomposition of carbamide."

By George Joseph Burrows and Charles Edward Fawsitt.

Previous investigations on the decomposition of carbamide in aqueous solutions by one of the authors (*Zeitsch. physikal. Chem.*, 1902, **41**, 603) have been extended to solutions in aqueous alcohol.

Addition of alcohol decreases the velocity of decomposition, but does not alter the mechanism of the reaction, which is a unimolecular one.

The theory already put forward that carbamide is not hydrolysed by water or aqueous solutions of acids is confirmed.

Carbamide decomposes primarily into ammonium cyanate, and is then decomposed into carbonate.

The authors believe that the decomposition of carbamide is the first chemical reaction to be investigated (1902), the mechanism of which demands the assumption of intermediate products, the existence of which has been proved.

258. "The viscosity of sugar solutions"

By Charles Wilfrid Roberts Powell.

The results of an investigation into the viscosities of aqueous solutions of sucrose, dextrose, and lævulose are given, dealing first with simple solutions containing only one of the sugars, and then with complex solutions containing mixtures of them.

The effect of temperature on the viscosity of these solutions is found to be well expressed by Poiseuille's equation:

$$\eta_t = \frac{\eta_0}{1 + \alpha t + \beta t^2},$$

where η_0 is the viscosity at 0° , η_t is the viscosity at t° , and α and β are constants. If the concentration of the solution is expressed as grams of solute per grams of solvent, the relation between viscosity and concentration is a logarithmic one, and may be represented by the equation $\eta_x = A^x$, where x is the concentration and A a constant.

A new method of calculation of the viscosity of simple solutions

is discussed, the time of flow of each of the constituents of the solution being calculated. By this means it is thought possible to examine the change in viscosity of the solute in concentrating solutions, as distinct from the change in viscosity of the solution.

A possible explanation of the deviation of the increase in viscosity of solutions with increasing concentration from any simple law is outlined. The theory given does not attempt to explain fully the question of viscosity, but indicates how the friction between different groups of molecules in the solution may definitely characterise the order of the change in viscosity with change in the composition of the solution.

It was found that for aqueous solutions of the three sugars mentioned, the two equations:

$$\eta_x = A^x,$$

$$\eta = \frac{m\eta_a + n\eta_b}{(m+n)},$$

may be used conjointly with a fair degree of accuracy to calculate the viscosity of a solution containing two or more of the sugars.

259. "The rate of hydration of acid anhydrides: acetic, propionic, butyric, and benzoic." By Bernard Howell Wilsdon and Nevil Vincent Sidgwick.

The velocity of this change was measured by Rivett and Sidgwick's method (T., 1910, 97, 732) by observing the rise in conductivity of the solution.

The conductivity of acetic acid was measured at 18°, of propionic at 18° and 25°, and of butyric at 25°. Approximately constant values of the dissociation constant are obtained in dilute solution if the conductivity of the water used is added to that of the solution.

The rate of hydration of the corresponding anhydrides was measured at the same temperatures, and also that of benzoic anhydride at 25°. The velocity of change of acetic anhydride is about twice that of propionic, about four times that of butyric, and about eight times that of benzoic.

With acetic anhydride at 18°, as was previously observed by Rivett and Sidgwick at 25°, the velocity decreases steadily with increase of concentration above about 0.2*N*; the same occurs with propionic anhydride above about 0.02*N*. The correction for the diminution in the concentration of the water only accounts for a small part of this fall. If, however, the activities of the two reacting molecules (water and anhydride) are assumed to be proportional to the fluidity of the solution, and the observed velocities are

multiplied by the square of the viscosity, the results are found to be constant (for both anhydrides and at both temperatures) within the limits of experimental error.

Monochloroacetic anhydride was found to be hydrated with a velocity too great for measurement—at least one hundred and fifty times that of acetic anhydride.

260. "Investigations on the dependence of rotatory power on chemical constitution. Part IV. The rotatory powers of the secondary alcohols of the formula $C_2H_5 \cdot CH(OH) \cdot R$." By Robert Howson Pickard and Joseph Kenyon.

A description is given of the synthesis and resolution of thirteen alcohols of the series $C_2H_5 \cdot CH(OH) \cdot R$. These optically active carbinols have been examined polarimetrically in the homogeneous state, and in alcoholic and in benzene solution. The results show that, whilst the molecular rotatory powers gradually increase as the series is ascended, there are further exaltations when the growing chain contains about five and about ten carbon atoms. It has been shown also that a similar effect on the molecular rotatory powers of the series $CH_3 \cdot CH(OH) \cdot R$ is only noticeable when these are determined in solution as in the homogeneous state the molecular rotatory powers of the carbinols of this series increase regularly with the mass of the compounds.

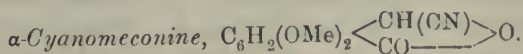
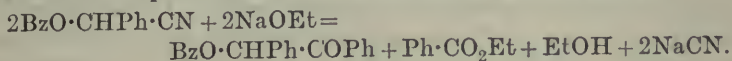
The optical rotatory dispersive power of the higher members of the series is a constant, and is independent of the temperature (from 20° to 160°).

The following communications have been received during the vacation:

261. "The mechanism of the benzoin synthesis." (Preliminary note.) By Gertrude Maud Robinson and Robert Robinson.

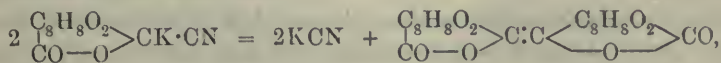
The investigation originated with the observation that cotarnine condenses with many aromatic aldehydes to form bases which are probably benzoylhydrocotarnines. With the idea of improving the yield and guided by Lapworth's well-known explanation of the benzoin synthesis, the authors attempted to prepare benzoyl hydrocotarnine (or its cyanohydrin) by the condensation of cotarnine with mandelonitrile in alcoholic solution; the products were, however, cyanohydrocotarnine and benzaldehyde. Cyanohydrocotarnine was also obtained when benzoylmandelonitrile (Francis and Dale, T., 1909, 95, 1404) was mixed with an equimolecular

amount of cotarnine in alcoholic solution. In this case the expected benzaldehyde and benzoic acid were produced in traces only; the main products were benzoylbenzoin (m. p. 125°) and ethyl benzoate, as well as a small proportion of benzyl benzoate. A similar result was achieved when the cotarnine was replaced by sodium acetate, potassium carbonate, or sodium ethoxide. With the latter the reaction is complete, and may be expressed by the equation:



Opianic acid (1 mol.) and potassium cyanide (1 mol.) react in aqueous solution with the production of the potassium salt of the cyanohydrin of opianic acid. The acid is a syrup readily soluble in water, and passes very slowly into the corresponding lactone, α -cyanoméconine; the loss of water occurs rapidly on boiling its solution in dilute hydrochloric acid. The substance crystallises from methyl alcohol in prismatic needles melting at 100—101°, and is sparingly soluble in alcohol or ether.

It is quantitatively hydrolysed to meconinecarboxylic acid (Fritsch, *Annalen*, 1898, **301**, 358) on boiling with concentrated hydrochloric acid for thirty seconds. This remarkable ease of hydrolysis must be ascribed to the recognised effect of a ring structure in increasing the reactivity of groups attached to it. The ready conversion of α -cyanoméconine to tetramethoxydiphthalyl by alkaline agents is analogous to the above production of benzoylbenzoin, and is best effected by potassium cyanide or cotarnine. The meconine hydrogen atom may be partly substituted by potassium (or cotarninium), and this intermediate substance may then condense either with itself:



or with a molecule of cyanomeconine, in which case a further substitution of hydrogen by potassium, followed by loss of potassium cyanide, must occur before tetramethoxydiphthalyl is reached. A similar series of reactions may explain the more complicated production of benzoylbenzoin, although there are alternative methods of expressing the elimination of ethyl benzoate. The authors consider that the formation of benzoin itself is concerned entirely with the aldehydecyanohydrin in its double function as reactive cyanide analogous to ethyl iodide, and as a phenylacetoneitrile with a hydrogen atom displaceable by alkali metals.

The action of potassium cyanide on mandelonitrile in boiling alcohol yields an oil which is probably benzoincyanohydrin; on treatment with sodium hydroxide in the cold, benzoin is produced. Many attempts to prepare mixed benzoins by different methods have been unsuccessful.

Incidentally, the authors have investigated the hydrolysis of acyl cyanohydrins, and find that these compounds are very well adapted for the preparation of mandelic acids. Benzoylmandelonitrile gives a good yield of benzoic and mandelic acids on prolonged boiling with concentrated hydrochloric acid, whilst on solution in sulphuric acid and subsequent dilution with water, benzoylmandelamide, $\text{BzO}\cdot\text{CHPh}\cdot\text{CO}\cdot\text{NH}_2$, is obtained. The latter crystallises from ethyl alcohol in feathery needles melting at $160\text{--}161^\circ$. Saturation of a solution of benzoylmandelonitrile (1 mol.) and ethyl alcohol (2 mols.) in dry ether with hydrogen chloride at 0° , and decomposition after twelve hours with alcohol and water, produces *ethyl benzoylmandelate*, $\text{BzO}\cdot\text{CHPh}\cdot\text{CO}_2\text{Et}$, a viscid oil boiling at $227^\circ/20\text{ mm.}$, together with a relatively small quantity of benzoylmandelamide.

Benzoyl-o-nitromandelonitrile, obtained in excellent yield from *o*-nitrobenzaldehyde, aqueous potassium cyanide, and benzoyl chloride, crystallises from alcohol in pale yellow needles melting at 89° , and yields on hydrolysis with concentrated hydrochloric acid, benzoic and *o*-nitromandelic acids.

262. "Some derivatives of phenanthraquinone." (Preliminary note.) By Kshitish Chandra Mukerjee and Edwin Roy Watson.

An investigation has been undertaken with the object of preparing derivatives with valuable dyeing properties from phenanthraquinone. Up to the present the following compounds have been obtained:

Nitro-2:7-diacetoxypheanthraquinone, $\text{C}_{14}\text{H}_5\text{O}_2(\text{OAc})_2\cdot\text{NO}_2$, prepared by dissolving 2:7-diacetoxypheanthraquinone in cold nitric acid (D 1.39) and plunging the containing vessel for one and a-half minutes into boiling water, crystallises from a mixture of acetic acid and acetone in yellowish-brown, rhombic prisms, which do not melt below 290° .

Nitro-2:7-dihydroxypheanthraquinone, $\text{C}_{14}\text{H}_5\text{O}_2(\text{OH})_2\cdot\text{NO}_2$, is obtained by hydrolysing the above acetyl derivative as a brown powder, which does not melt below 290° .

Amino-2:7-dihydroxypheanthraquinone, $\text{C}_{14}\text{H}_5\text{O}_2(\text{OH})_2\cdot\text{NH}_2$, prepared by reducing the nitrodiaacetoxypheanthraquinone with tin and hydrochloric acid and treating the product with warm

ferric chloride solution, consists of deep brown, small, rectangular plates, is insoluble in all ordinary organic solvents, dissolves in alkali hydroxide with a brown colour, and does not melt below 290° . Its *triacetyl* derivative, $C_{14}H_5O_2(OAc)_2 \cdot NHAc$, does not melt below 295° .

2 : 7 : ? - *Trihydroxyphenanthraquinone*, $C_{14}H_5O_2(OH)_3$. — The aminodihydroxy-compound is diazotised in ice-cold 10 per cent. sulphuric acid, and the filtered diazo-solution on boiling precipitates the trihydroxyphenanthraquinone as a reddish-brown substance, which does not melt below 290° , can be dissolved in pyridine and precipitated by alcohol, and dissolves in alkali with a brown colour. Its *triacetyl* derivative, $C_{14}H_5O_2(OAc)_3$, deposited as a reddish-brown, microcrystalline powder from glacial acetic acid, melts at about 280° .

2 : 7 - *Diacetylaminophenanthraquinone*, $C_{14}H_6O_2(NHAc)_2$, is prepared by heating 2 : 7-diaminophenanthraquinone with acetic anhydride and fused sodium acetate at 160° for one hour in a sealed tube. It is a chocolate-brown coloured substance, readily soluble in acetic acid, sparingly so in alcohol, and does not melt below 295° .

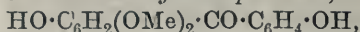
Phenanthraquinone - 2 : 7 - bisazophenol, $C_{14}H_6O_2(N_2 \cdot C_6H_4 \cdot OH)_2$, prepared by diazotising 2 : 7-diaminophenanthraquinone in 5 per cent. sulphuric acid and coupling with phenol, crystallises from a mixture of alcohol and nitrobenzene in brown, lenticular crystals, which do not melt below 295° , and dissolve in alkali with a brown colour. The *diacetyl* derivative, $C_{14}H_6O_2(N_2 \cdot C_6H_4 \cdot OAc)_2$, crystallises from acetic acid in brick-red, rhombic prisms, melting at 274° .

263. "Some derivatives of 2 : 3 : 4 : 2'-tetrahydroxybenzophenone."
(Preliminary note.) By Narendra Nath Sen Gupta and Edwin Roy Watson.

This investigation has been undertaken with the object of preparing dyes of deep colour by replacing the ketonic group of the polyhydroxybenzophenones by the arrangement $CR(OH)$. Up to the present the following derivatives of 2 : 3 : 4 : 2'-tetrahydroxybenzophenone have been prepared :

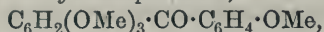
2 : 3 : 4 : 2' - *Tetrahydroxy-4''-dimethylaminotriphenylcarbinol anhydro-hydrochloride*, $C_6H_2(OH)_3 \cdot C(C_6H_4 \cdot OH) : C_6H_4 : N(CH_3)_2Cl (?)$, prepared by the action of a mixture of dimethylaniline and phosphoryl chloride on the tetrahydroxybenzophenone, is a crimson, amorphous substance, melting at $184-185^{\circ}$, and decomposing at 200° , which dyes crimson shades on wool mordanted either with chromium or tin.

2:2'-Dihydroxy-3:4-dimethoxybenzophenone,

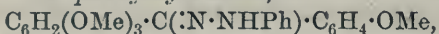


obtained by the interaction of *o*-methoxybenzoyl chloride and pyrogallol trimethyl ether in the presence of anhydrous aluminium chloride, crystallises from alcohol in yellow, needle-shaped crystals, melting at 127°.

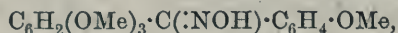
2:3:4:2'-Tetramethoxybenzophenone,



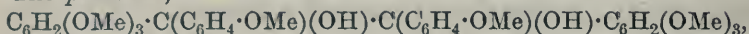
obtained by the action of methyl sulphate and potassium hydroxide on tetrahydroxybenzophenone or on 2:2'-dihydroxy-3:4-dimethoxybenzophenone, crystallises from dilute alcohol in colourless prisms, melting at 83°. Its *phenylhydrazone*,



crystallises from alcohol and melts at 153°. Its *oxime*,



crystallises from alcohol and melts at 166°.

The *pinacone*,

obtained by the action of zinc dust and acetic acid on the tetramethoxybenzophenone, is purified by crystallising in succession from glacial acetic acid and alcohol, and forms colourless, needle-shaped crystals, melting at 185—186°.

264. "The constitution of phenolphthalein and its alkali salts."

By Morris Fort and Frank Leslie Barrett.

Green and Perkin (T., 1904, 85, 398) have described a method of titrating a cooled, colourless solution of phenolphthalein in a known excess of potassium hydroxide with acetic acid. Using 0.5 gram of phenolphthalein, they found 17.6 per cent. of potassium hydroxide to remain unestimated by the acid, that is, the amount calculated for $\text{C}_{20}\text{H}_{15}\text{O}_5\text{K}$. The titrated solution was clear and colourless, becoming deep red and alkaline to litmus on heating, whilst a precipitate of phenolphthalein also separated out, and on again cooling these features persisted. It does not appear from the account of this work that the possible reaction between phenolphthalein and potassium acetate had been taken into account, whereas it is now found that a colourless mixture of these two substances in solution becomes red and alkaline to litmus on heating, remaining so on keeping until cold. The reaction is by no means unique, and belongs to the class of "neutral salt reactions" due to the operation of mass law (Fort, *J. Soc. Dyers*, 1912, 28, 314; 1913, 29, 80, 120, 269; *Chem. News*, 1913, 108, 1). The mere colour changes occurring on heating after titration as described

have since been instanced in support of the quinonoid theory of colour (Green, *J. Soc. Chem. Ind.*, 1908, **27**, 4), but now lend no support apart from the quantitative results, which appear liable to a considerable working error, being calculated from 0.65 c.c., where 0.1 c.c. = 3.7 per cent. KOH.

Green and Perkin's experiment was therefore repeated, using also larger amounts of phenolphthalein up to 3 grams, and a series of results was obtained varying within the limits of error assigned above, for example, 16.65, 18.14, 16.10, etc. The average of ten successive experiments gave 17.54 per cent. of potassium hydroxide ($\text{C}_{20}\text{H}_{16}\text{O}_5\text{K}$ requires 17.6 per cent. KOH). (a) The amount of potassium combined with phenolphthalein as a colourless salt was also estimated directly with acetic acid, after heating and re-cooling with ice, and found to agree with the above indirect estimation. (b) At the same time, to decide as to the condition of phenolphthalein and the equilibrium obtaining in the red alkaline solution, the colourless solution of the monopotassium salt was closely imitated with a red solution containing fresh phenolphthalein, potassium hydroxide, and potassium acetate, and these intensely red and colourless liquids were heated side by side until of a similar intense red, behaving quite similarly on cooling with ice and titrating with acetic acid. There can therefore be little doubt as to the isomeric change taking place from the less stable, colourless monopotassium salt of phenolphthalein, to the coloured quinonoid salt. (c) Neutral salt reactions are greatly retarded by lowering of temperature as in the titrations in (a) and (b); however, in order to determine the highest possible error from this cause, a blank experiment with phenolphthalein and potassium acetate was performed alongside (a) and (b), showing that the quantitative results are liable to be affected by the neutral salt reaction to only a small extent.

The experiments were made in duplicate, comparative throughout. The potassium hydroxide solution contained 177.184 grams of the alkali per litre, and 25 c.c. of the acetic acid were equivalent to 20.6 c.c. of potassium hydroxide solution.

(a) One gram of phenolphthalein and 20 c.c. of potassium hydroxide solution were taken; after preparation of the colourless salt it was heated in the water-bath one hour under an air condenser, cooled with ice, and titrated to a permanent pale pink colour requiring 1.20 c.c. of acetic acid = 17.5 per cent. KOH. The faint pink at the end-point can be removed with a considerable excess of acetic acid, and is ascribed to the presence of potassium acetate:



(b) One gram of phenolphthalein, 9.95 c.c. of potassium hydr-

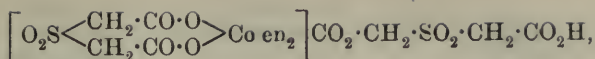
oxide solution, and 6.1968 grams of anhydrous potassium acetate were used; the volume was as in (a) after the preparatory titration. The solution was heated, cooled, and titrated as in (a) to a pale pink: 1.2 c.c. of acetic acid were required = 17.5 per cent. KOH. ($C_{20}H_{15}O_5K = 17.6$ per cent. KOH.)

(c) One gram of phenolphthalein and 6.1968 grams of potassium acetate were used, the volume being as in (a) and (b), alongside which the solution was heated, cooled, and titrated to a pale pink: 0.12 c.c. of acetic acid was required = 1.7 per cent. KOH. The intense red colour given on heating is largely retained at the ordinary temperature, but much reduced at 0° . The figure obtained from a duplicate experiment titrated at the boiling point after an hour's heating in the water-bath was 0.29 c.c. of acetic acid = 4.23 per cent. KOH.

These results support the main conclusions drawn by Green and Perkin, and are in agreement with the quinonoid formulæ adopted by them for coloured phenolphthalein salts.

65. "Complex metal ammonias. *cis*-Sulphonyldiacetatodiethylenediaminecobaltic hydrogen sulphonyldiacetate." (Preliminary note.) By Thomas Slater Price and Sidney Albert Brazier.

In his investigations of the complex cobalt ammonias, Werner has prepared a number of salts of the type $[A \cdot Co en_2]X$, where A is the radicle of a dibasic acid. So far the sulphito-, carbonato-, oxalato-, and malonato-radicles have been introduced into the complex, but Werner has not been able to obtain crystalline compounds containing the next higher homologue to the malonato-radicle, namely, the succinato-radicle, or containing the radicles of malic and tartaric acids (*Annalen*, 1911, **386**, 81). It occurred to the authors that the introduction of the sulphur atom into the chain of carbon atoms in the acid used might lead to interesting results in this connexion, and Prof. Werner having kindly informed them that he did not contemplate working with such compounds, and would leave the field open to them, an investigation was commenced, using thiodiacetic acid, $S(CH_2 \cdot CO_2H)_2$. Definitely crystalline compounds were obtained, but the results were complicated by the fact that during the preparation, partial reduction of the cobalt compound took place, and the authors have not yet been able to characterise the compounds formed. In order to avoid this complication, the thiodiacetic acid was replaced by sulphonyldiacetic acid, $SO_2(CH_2 \cdot CO_2H)_2$, and the compound *cis-sulphonyldiacetatodiethylenediaminecobaltic hydrogen sulphonyldiacetate*,



has been prepared.

The method of preparation was similar to that used by Werner for the corresponding malonato-compound (*loc. cit.*, p. 79). Four grams of *cis*-carbonatodiethylenediaminecobaltic bromide were dissolved in 80 c.c. of warm water, and, after cooling, 2.20 grams of freshly prepared silver oxide were added to the solution. The mixture was well shaken for half an hour, and then filtered from the silver bromide into an aqueous solution of 5.63 grams of sulphonyldiacetic acid, the proportions being 2 mols. of the acid to 1 mol. of the carbonato-base. The resulting solution, after evaporating to a small bulk on the water-bath, deposited crystals of the desired compound. One recrystallisation from water gave the pure salt, in dull, rose-coloured, microscopic crystals, which are readily soluble in hot, but somewhat sparingly soluble in cold water:

0.2687 gave 0.0767 CoSO_4 . $\text{Co} = 10.86$.

0.1797 „ 16.65 c.c. N_2 (moist) at 19° and 749.3 mm. $\text{N} = 10.45$.

0.3045 „ 0.2618 BaSO_4 . $\text{S} = 11.81$.

$\text{C}_{12}\text{H}_{25}\text{O}_{12}\text{N}_4\text{S}_2\text{Co}$ requires $\text{Co} = 10.91$; $\text{N} = 10.37$; $\text{S} = 11.87$ per cent.

The authors are extending the investigation to other sulphur compounds and complex metal ammonias.

Extra Meeting, Thursday, October 23rd, 1913, at 8.30 p.m., Prof. W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The Ladenburg Memorial Lecture was delivered by Prof. F. Stanley Kipping, D.Sc., F.R.S., and at the conclusion of the lecture a vote of thanks to Prof. Kipping was proposed by Prof. H. E. Armstrong, F.R.S., seconded by Prof. W. Jackson Pope, F.R.S., and acknowledged by the Lecturer.

Thursday, November 6th, 1913, at 8.30 p.m., Prof. W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the heavy loss the Society had sustained through death, during the vacation, of the following Fellows:

	<i>Elected.</i>	<i>Died.</i>
E. L. Barret (Paris)	February 4th, 1869	1912
J. C. Bell (Manchester)	January 19th, 1865	July 1st, 1913
A. Cantin (Mauritius)	June 21st, 1900	February 12th, 1912
T. Crossman (Starbeck)	February 21st, 1895	July 13th, 1913
J. Davidson (Holywell Green)...	May 18th, 1876	June 9th, 1913
L. M. Deane (Ilkley)	March 4th, 1886	July 26th, 1913
Sir W. N. Hartley (Dublin) ...	December 20th, 1866	September 11th, 1913
J. Lewkowitsch (W. Hampstead)	February 16th, 1888	September 16th, 1913
H. Marshall (Dundee)	February 6th, 1890	September 6th, 1913
I. Patchett (Batley)	April 21st, 1870	April 10th, 1913
M. G. Roy (Chintadrepettah)...	June 21st, 1900	April 8th, 1913
A. Wallace (Agra)	May 2nd, 1912	June 25th, 1913

The following announcements were made :

1. That a meeting of the Faraday Society would be held here on Wednesday, November 12th, from 4.30 to 9.30 p.m., when a general discussion on "The Passivity of Metals" would take place. Fellows of the Chemical Society were invited to attend the meeting.

2. That, in future, a list of the papers to be read at each Ordinary Scientific Meeting will be advertised in the *Morning Post* on the Wednesday previous to the day of meeting.

Messrs. C. K. Tinkler and E. Cahen were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs. :

Richard Watson Askew, B.A., Brierley, Chelmsford Road, Durban, Natal, South Africa.

Sankar Rao B. Badami, M.A., Badami House, Hulsurpet, Bangalore, India.

Stanley Charles Bate, B.Sc., 50, Alexandra Road, Upper Norwood, S.E.

Charles Maurice Berlein, B.A., Cross Oak, Berkhamsted.

Arthur Bicknell, B.Sc., Balliol College, Oxford.

Augustus Pearce Llewellyn Blaster, B.A., Chidham, Potters Bar, Middlesex.

Adhor Krishna Bose, 90, Musjeed Barea Street, Calcutta, India.

Arthur Bramley, B.Sc., 19, Cambridge Road, Barnes, S.W.

Arthur Joseph Brearley, B.A., 13, Victoria Terrace, Exeter.

Bertram Campbell, B.Sc., Beechover, Manor Avenue, Grimsby.

Frederick George Carter, Amritsar Distillery, Amritsar, Punjab, India.

Santi Pada Chowdry, Economic Research Laboratory, Rewa State Industries, Umaria, India.

Francis William Clark, 35, Wilmington Square, W.C.

Herbert Stoddard Coleman, 14, Dunsford Road, Bearwood Road, Smethwick.

Thomas James Drakeley, B.Sc., 36, Mitchell Street, Newtown, Wigan.

Cyril Duncan Fuller, 62, Hill Street, Totterdown, Bristol.

Charles John Dickenson Gair, 39, Cranston Road, Forest Hill, S.E.

Stanton Gibson, B.Sc., 28, Lordship Park, N.

Richard Hargreaves, B.A., Chatburn, Clitheroe.

George Alfred Hebden, 78, Norborough Road, Tinsley, Sheffield.

Richard Pendarves Hodges, 42, Olive Road, Cricklewood, N.W.

William Francis Hollely, 67, Ross Road, Wallington, Surrey.

Alexander Hynd, M.A., B.Sc., 196, Baldridgeburn, Dunfermline.

William Johnson, B.Sc., Walton, Stoneygate Avenue, Leicester.

Harold Bramfield Jones, Broadway House, Northolme Road, Highbury, N.

Gholam Rasal Khan, B.Sc., Lyallpur, Punjab, India.

Sidney Oliver Leivesley, c/o W. Leivesley, Esq., Chillagoe, N. Queensland, Australia.

William John Lewis, 10, Lightoaks Road, Pendleton, Manchester.

Percival James Lycett, Castle Hill, Wolverley, Kidderminster.

Frank Clifford Marchant, St. Kilda's, Manor Road, Forest Hill, S.E.

Kunerji Gosai Naik, M.A., B.Sc., Krishnath College, Berhampore, Dist. Murshidabad, Bengal, India.

John Allen Nichols, Stanley Mount, New Mills, Stockport.

John Thomas Pattison, 72, Bath Road, Southsea, B.O. Portsmouth.

Wilfrid Roberts Powell, B.A., 14, Marlborough Road, Richmond, Surrey.

Henry Edward Findlater Pracy, 25, Grosvenor Park, Camberwell, S.E.

John McArthur Stuart, Balliol College, Oxford.

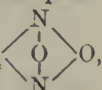
Robert Tennant, 4, Park Terrace, Queen's Park, Glasgow.

Henry Walker, 10, Melrose Terrace, West Kensington Park, W.

Henry Wood, The Limes, 62, Culverden Road, Balham, S.W.

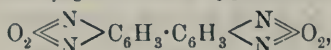
Of the following papers, those marked * were read:

- *266. "The conversion of orthonitroamines into *isoox*diazole oxides (furoxans)." By Arthur George Green and Frederick Maurice Rowe.

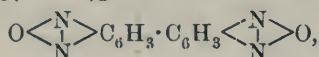
Whilst *o*-nitroaniline on alkaline hypochlorite oxidation is quantitatively converted into benzisooxadiazole oxide, C_6H_4 ,

and 2:4-dinitroaniline (when an alcohol is present) into a chloromethoxy-(or ethoxy-)benzisooxadiazole oxide, the presence of an amino-, acetylamino-, azo-, or sulphonic group in the para-position occasions a complete disruption of the benzene ring, and only in the case of the sulphonic acid was a small quantity of a benzisooxadiazole oxide produced.

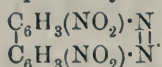
The two isomeric *o*-dinitrobenzidines (Cain, Coulthard, and Micklethwait, T., 1912, **101**, 2298), when subjected to hypochlorite oxidation under like conditions, yield entirely different products. Whilst the isomeride melting at 275° (regarded by these authors as 3:5'-dinitrobenzidine) produces a typical furoxan,



readily convertible on reduction into a diphenoquinonetetraoxime, $\text{C}_6\text{H}_3(\text{:NOH})_2 \cdot \text{C}_6\text{H}_3(\text{:NOH})_2$, and a bisbenzisooxadiazole,



the isomeric *o*-dinitrobenzidine melting at 233°, regarded as the 3:3'-derivative, gives a reddish-brown, crystalline compound of the formula $\text{C}_{12}\text{H}_6\text{O}_4\text{N}_4$, which is probably an internal azo-compound,

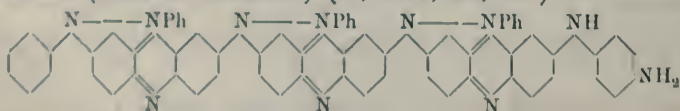


The above bisbenzisooxadiazole oxide (bisbenzfuroxan) crystallises from chlorobenzene in pale yellow, thin, hexagonal plates, melting at 211°. The corresponding bisbenzisooxadiazole (bisbenzfurazan) forms yellow needles, which melt at 244°. The diphenoquinonetetraoxime is a brown, amorphous powder, soluble in alkalis. The authors have also repeated and confirmed the work of Drost (*Annalen*, 1899, **307**, 54) on the nitration products of benzisooxadiazole oxide. Both the mono- and the di-nitrobenzisooxadiazole oxides, which are thus obtained, have strongly marked acid properties, turning Congo paper blue and dissolving readily in aqueous alkalis.

*267. "The constitution of aniline-black. Part IV."

By Arthur George Green and William Johnson.

In further support of Green and Wolff's formula for aniline-black base (chlorate oxidation) (P., 1912, **28**, 250):



the following data have been obtained :

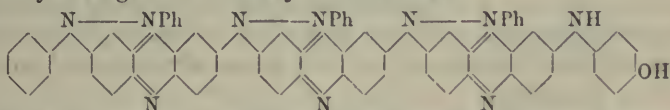
(1) On oxidation of aniline-black with lead peroxide and sulphuric acid a yield of benzoquinone is obtained, which corresponds with that required on the assumption that all the mono- and di-substituted benzene nuclei, but not the tri-substituted, will yield benzoquinone.

(2) In presence of an excess of mineral acid aniline-black absorbs one molecule of sodium nitrite corresponding with the formation of a monodiazonium salt. Hence the terminal nitrogen atom forms an amino- and not an imino-group, and the chain must be an open one.

(3) Titrations with hydrochloric acid have shown that aniline-black, in common with emeraldine and nigraniline, yields a non-hydrolysable dihydrochloride and a trihydrochloride, in which one molecule of hydrogen chloride is readily hydrolysed. Two of the nitrogen atoms are therefore strongly basic (quinonoid), whilst a third is weakly basic (amino-group). Leucoemeraldine, which contains no quinonoid nitrogen, does not give a stable hydrochloride.

(4) Nigraniline does not condense with secondary aromatic amines, but only with primary amines.

(5) The variety of aniline-black produced in solution by oxidation with chromic acid and known as "single bath black," or "bichromate black," has given results which indicate that it is the hydroxy-analogue of ordinary aniline-black:



It is less basic than ordinary aniline-black, forming a non-hydrolysable dihydrochloride, but not a trihydrochloride. On oxidation it gives a yield of benzoquinone consistent with the formula given. In the above formulæ the colouring-matters are represented as anhydro-bases, but in both cases analysis indicates the presence of $\text{1H}_2\text{O}$ more, a fact explainable on the assumption that one phenylazonium group is present as an hydroxide or two such groups as an oxide.

DISCUSSION.

Professor J. T. HEWITT agreed with Dr. Lowry in not liking an ortho-quinonoid formula for the free anhydrous bases of the safranine series. The linking of a quinquevalent nitrogen atom to a tervalent nitrogen atom attached to the same nucleus but in the meta-position seemed quite improbable, and when similar structures were given to *aposafranone* and its derivatives, the compounds were represented as betaines of a weakly acid phenolic

group with a quaternary ammonium (powerfully basic) compound. This was at variance with the actual properties of *aposafranone* and its hydroxy-derivatives, since their basic properties were feeble. Arguments of a similar character might be urged against Professor Green's quaternary ammonium oxide formula for the hydrates of compounds of aniline-black type.

***268 "The constituents of senna leaves." By Frank Tutin.**

Three specimens of senna leaves have been submitted to examination, namely: (I) Tinnevely senna leaves (*Cassia angustifolia*, Vahl); (II) senna leaves from Lima, Peru, which were found to be botanically identical with the Tinnevely leaves; and (III) Alexandrian senna leaves (*Cassia acutifolia*, Delile).

The Tinnevely leaves yielded, in addition to a small amount of essential oil, chlorophyll, and resinous products, the following definite substances: (i) Salicylic acid; (ii) rhein; (iii) k  mpferol; (iv) alo  -emodin; (v) *kaempferin*, $C_{27}H_{30}O_{16} \cdot 6H_2O$ (m. p. 185  195  ), a new glucoside of kaempferol; (vi) a mixture of the glucosides of rhein and alo  -emodin; (vii) the magnesium salt of an unidentified organic acid; (viii) dextrose; (ix) myricyl alcohol; (x) a phytosterol; (xi) a phytosterolin, $C_{33}H_{56}O_6$; (xii) palmitic and stearic acids.

The Peruvian and Alexandrian senna leaves contained the above-mentioned compounds, with the exception of the magnesium salt, and, in addition, *isorhamnetin*. The latter also occurred in the form of a glucoside.

The statements of Tschirch and Hiepe (*Arch. Pharm.*, 1900, **238**, 427), that senna leaves contain "senna-*isoemodin*," "sennachrysophanic acid" (chrysophanol), a "substance, $C_{14}H_{10}O_5$," and "sennarhamnetin," cannot be confirmed, it having been ascertained that the anthraquinone derivatives present consist solely of rhein and alo  -emodin, whilst the flavone product is either kaempferol, or a mixture of the latter with *isorhamnetin*.

***269. "A series of mixtures of nitro-compounds and amines, which are coloured in the liquid state only." By Charles Kenneth Tinkler.**

Certain nitro-compounds, when dissolved in fused diphenylamine and other amines, give strongly coloured solutions. The colour, however, entirely disappears on complete solidification of the mixture.

The most suitable substances for the demonstration of this phenomenon are mixtures of diphenylamine with one of the following nitro-compounds: *o*-, *m*-, and *p*-chloronitrobenzene, *m*- and *p*-nitrobenzaldehyde, *p*-bromonitrobenzene, tetranitromethane. By enclosing one of these mixtures between two test-tubes placed one inside the other, the phenomenon is well demonstrated. Thus, a mixture of diphenylamine and *p*-chloronitrobenzene, which is colourless at the ordinary temperature, acquires a reddish-yellow colour when held in the hand, and loses this colour when the temperature falls.

A mixture of diphenylamine and *p*-nitrobenzaldehyde shows a deep red colour at slightly above body temperature, returning to the colourless state on cooling.

A mixture of diphenylamine (solid) and tetranitromethane shows a dark brown coloration, but in a freezing mixture this colour is entirely removed.

From analogy to compounds of amines and nitro-derivatives, such as trinitrobenzene (Hepp, *Annalen*, 1882, **215**, 344; Sudborough, T., 1901, **79**, 522; 1902, **81**, 587, etc.; Noelting and Sommerhoff, *Ber.*, 1906, **39**, 76, and others), it is possible that the colour of these mixtures is due to the combination of the nitro-derivative and amine in the liquid state only. No direct evidence of compound formation has, however, so far been obtained from the various physico-chemical investigations which have been carried out.

Certain phenols and other substances may be substituted for the amine in the demonstration of the phenomenon, and the investigation is being extended in this direction.

DISCUSSION.

In reply to the President, Dr. TINKLER said that the transient colorations produced were usually orange-red or red, although in the case of diphenylamine and tetranitromethane a very dark brown coloration was obtained. No transient blue or green colorations had been observed.

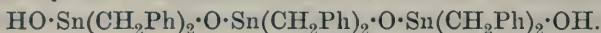
With reference to Dr. Senter's suggestion that the colour might be due to the presence of a small quantity of compound, Dr. Tinkler pointed out that, so far, no such indication had been obtained by the physico-chemical investigations which had been carried out with the mixtures. If, however, a compound was formed at all, it did not exist in the solid state, or the mixture would remain coloured on solidification and precipitation from solution.

270. "A study of some organic derivatives of tin as regard their relation to the corresponding silicon compounds. Part II. Condensation products of dihydroxydibenzylstannane." By Thomas Alfred Smith and Frederic Stanley Kipping.

Organic derivatives of tin of the general formula $\text{SnR}_2(\text{OH})_2$ are unknown, but various oxides, SnR_2O , insoluble in all organic solvents, have been prepared.

The authors have attempted to obtain compounds of the dihydroxy-type in order to ascertain whether they are capable of existence, and, if so, whether they would give rise to open- and closed-chain condensation products analogous to those recently prepared from diphenylsilicanediol (Kipping, T., 1912, 101, 2125).

The first product of the hydrolysis of dibenzylchlorostannane with dilute potassium hydroxide solution seems to be the potassium derivative of the dihydroxy-compound; from the solution of this substance carbonic acid precipitates a solid, which is probably dibenzyl-dihydroxystannane, $\text{Sn}(\text{CH}_2\text{Ph})_2(\text{OH})_2$, but this compound is very unstable, and passes into a condensation product, which has probably the constitution:



This condensation product, unlike all the oxides, SnR_2O , is readily soluble in various organic solvents; when heated alone or in boiling bromobenzene solution, it passes into an insoluble oxide, which has probably the molecular formula $[\text{Sn}(\text{CH}_2\text{Ph})_2\text{O}]_3$.

It may be concluded that all the insoluble oxides, $[\text{SnR}_2\text{O}]_n$, are condensation products of the unknown hydroxides; similarly, the ill-defined acids of the composition H_2SnO_3 are probably mixtures of even more complex condensation products of stannic hydroxide.

271. "6'-Aminoquercetin." By Edwin Roy Watson.

A detailed description of work of which a preliminary account has already appeared (P., 1911, 27, 163).

272. "Measurement of the rate of reaction by the change of volume in solution." By Robert Wright.

Although the alteration of volume resulting from chemical change has frequently been used to follow the course of a gaseous reaction—the formation of water vapour from its elements, for example—still it has seldom or never been applied to the case of reacting solutions. Such solution change is, as a rule, undoubtedly small, but even if it only amounts to about 0.2 per cent. of the total

volume, it gives a convenient physical method for the determination of reaction velocities.

A few well-known reactions have been investigated in this manner, but in some cases the change of volume is too small to be of service. For example, on heating an aqueous solution of pyrophosphoric acid in a sealed tube for several hours at 100° , only a very slight change in the density of the solution takes place; and the same negative result is obtained by a similar heating of a solution of potassium cyanide. The hydrolysis of methyl acetate by sodium hydroxide is accompanied by considerable contraction in the reacting solution, but the change is inconveniently rapid, and the results are also masked by the rise of temperature which occurs.

The rate of inversion of sucrose by an acid can readily be followed by means of the change of volume. A mixture of equal volumes of a 20 per cent. solution of sucrose with 2*N*-hydrochloric acid showed the following densities before and after inversion:

(a) After mixing.. .. .	1.0474	(b) After mixing.....	1.0476
After 48 hours	1.0497	After 48 hours	1.0497

thus giving a contraction of volume equal to about 0.2 per cent.

In the determination of the velocity-constant, the apparatus shown was used. A pipette of about 50 c.c. capacity has its upper tube of 1 mm. bore and 25 cm. long, the lower tube, which is fitted with a stopcock, passes through a rubber cork, and reaches almost to the bottom of a 150 c.c. flask; a side-tube open to the air also passes through the rubber stopper.

The pipette is first charged with a 20 per cent. solution of sucrose, which is run into the flask, and a few grains of mercuric iodide are added as preservative; the pipette is then rinsed out and charged with 2*N*-hydrochloric acid, and the stopcock being closed, it is placed in position in the flask. The apparatus is now immersed in a thermostat at 25° , and allowed to attain the temperature of the bath; the tap is opened, and by applying suction to the side-tube the acid is drawn into the flask; the mixture is well stirred by drawing air through it, and is then forced back into the pipette until it stands at a level of a few cm. from the top of the capillary tube. It is absolutely essential to have some of the mercuric iodide carried into the pipette along with the solution, otherwise fermentation of the sugar will cause minute bubbles of gas to be formed; for the same reason it is necessary to steam out the apparatus before use. The



pipette being charged, the tap is closed, and the level of the liquid in the tube read; this gives the zero reading. The fall of the liquid is now read at definite intervals, and a final reading is taken after forty-eight hours, when the total fall should be from 10 to 20 cm. The velocity-constant may now be calculated in a manner quite analogous to that used with the polarimeter.

In the following example a = final distance between the level of the liquid and the top of the tube, and x_1 and x_2 are the distances corresponding with the times t_1 and t_2 . Then k , the velocity-constant, is given by:

$$k = \frac{1}{t_2 - t_1} \log \frac{a - x_1}{a - x_2}$$

Time in		Reading from top.	K .
hrs.	min.		
0	0	15.0 mm.	0.01177
0	15	23.0 "	0.00483
0	30	29.5 "	0.00479
0	45	35.5 "	0.00498
1	0	41.3 "	0.00489
1	30	51.5 "	0.00470
2	0	60.0 "	0.00450
2	30	67.0 "	0.00473
3	0	73.5 "	
48	0	$a = 116.0$ "	

Leaving out of consideration the first value of K which is affected by the rise of temperature at the beginning of the reaction, it is seen that the numbers agree to within about 5 per cent. of each other, the true value given by the polarimeter being 0.00470.

273. "Amalgams containing silver and tin."

By William Arthur Knight and Reginald Arthur Joyner.

It was again shown that the ageing of alloys of silver and tin is not due to superficial oxidation. A bar of alloy does not age appreciably even after fifteen days at 115°, whereas filings of the same bar are aged after half an hour at 100°. Hence it is concluded that ageing is not due to any uncatalysed polymorphic change in the Ag_3Sn contained in the alloy. It was also proved that ageing is not due to sorption of oxygen by the filings. A further hypothesis to be tested is that it may be due to catalytic action of the iron or products of iron introduced during the filing.

The equilibrium of the metals silver, tin, and mercury at temperatures of 63°, 90°, 166°, and 214° has also been studied. The liquidus has been completely determined at these temperatures, and consists of a line roughly parallel to the Sn-Hg side of the equilateral triangle. At 63° this line only extends about one-tenth of the distance across the diagram, whereas at 214° it stretches

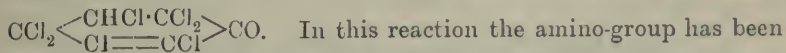
nearly the whole way across. The solidus has not, as yet, been determined accurately, but there are good reasons for considering that, commencing at the point Ag_3Hg_4 , it extends across the diagram roughly in the direction of Ag_3Sn . It has been proved that the substances represented by points on the solidus must be solid solutions.

274. "The action of chlorine on *m*-iodoaniline and on *m*-bromoaniline." By Hamilton McCombie and Percy James Ward.

When *m*-iodoaniline is chlorinated in glacial acetic acid solution, 2:4:6-trichloro-3-iodoaniline is treated with alcoholic ethyl 2:4:6-trichloro-3-iodoaniline is produced. Under no conditions could an iododichloride be obtained; this is contrary to the experience of Willgerodt and Wikander (*Ber.*, 1907, **40**, 4068), who considered that they obtained an unstable iododichloride. When nitrite, 2:4:6-trichloriodobenzene is produced, which has been described previously by several observers. 2:4:6-Trichloro-3-iodoaniline could not be converted into a hydrochloride, nor could it be benzoylated in presence of sodium hydroxide.

The acyl derivatives of *m*-iodoaniline showed a slight tendency to the formation of iododichlorides, but these proved to be very unstable, and readily yielded ring substitution products.

The prolonged action of chlorine on *m*-iodoaniline resulted in the formation of 2:2:3:4:4:6-hexachloro-5-iodo- Δ^5 -cyclohexenone,



In this reaction the amino-group has been removed in the form of ammonium chloride, whilst the iodine atom still remains in the molecule. The constitution of this ultimate chlorination product is based on the following reactions: (1) On treatment with potassium iodide, the compound yields 2:4:6-trichloro-3-iodophenol. (2) On treatment with potassium acetate in the presence of acetic acid, there results 2:3:4:6-tetrachloro-5-iodophenol. (3) Concentrated sulphuric acid converts the compound into 2:3:6-trichloro-5-iodo-*p*-benzoquinone.

Analogous results have been obtained on chlorinating *m*-bromoaniline under the same conditions as were employed for the iodo-compound.

275. "Guanidinium nitrite and its decomposition by heat." By Prafulla Chandra Rây, Manik Lal Dey, and Sarat Chandra Jâna.

Guanidinium nitrite, from the conductivity measurement of its aqueous solution, is found to behave like a typical alkaline nitrite with two ions.

When heated, guanidinium nitrite yields ammonia, hydrocyanic acid, nitrogen monoxide, and nitrogen among the gaseous products, and leaves a residue which was proved to be melamine.

276. "The absorption of light by uranous chloride in different solvents." By Thomas Ralph Merton.

The absorption spectra of uranous chloride solutions in different solvents have been investigated, more especially in the presence of free hydrogen chloride. In some cases the presence of a small quantity of water produces a marked change in the absorption spectrum. It is concluded that the vibrators responsible for different bands or groups of bands are situated in different molecular aggregates.

277. "The influence of solvents on the rotation of optically active compounds. Part XIX. The rotation of certain derivatives of lactic acid." By Thomas Stewart Patterson and William Collins Forsyth.

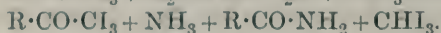
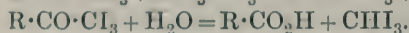
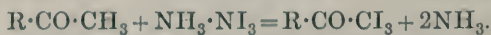
The rotation of several derivatives of lactic acid has been examined, over a range of temperature, both in the homogeneous state and in solution in two solvents, which usually differ widely in their action.

278. "The action of nitrogen iodide on methyl ketones."

By Frederick Daniel Chattaway and Robert Reginald Baxter.

Ketones containing a methyl group react very readily with nitrogen iodide, iodoform, ammonia, an acid, and an amide being formed. In the reaction the methyl group appears to be completely substituted by iodine, a tri-iodomethyl ketone being formed, which in presence of the ammonia simultaneously set free is hydrolysed to iodoform and an acid, a similar reaction between the substituted ketone and ammonia leading to the formation of iodoform and an amide.

The reactions may be formulated thus:



The reaction between nitrogen iodide and acetone is particularly striking, as the black solid in a few minutes is apparently transformed into a bright yellow one.

279. "Note on the constituents of commercial chrysarobin."

By Frank Tutin and Hubert William Bentley Ciewer.

In a recent communication (T., 1912, 101, 290) the authors described the results of the examination of several samples of commercial chrysarobin. During the course of this research the following substances were isolated: Chrysophanol ("chrysophanic acid"), $C_{15}H_{10}O_4$; emodin monomethyl ether, $C_{16}H_{12}O_5$; chrysophanolanthranol, $C_{15}H_{12}O_3$; dehydroemodinanthranol monomethyl ether, $C_{16}H_{12}O_4$; ararobinol, $C_{23}H_{16}O_5$; and emodin, $C_{15}H_{10}O_5$.

It was furthermore pointed out that commercial chrysarobin is subject to considerable variation in the relative proportions of its constituents, some samples being even entirely devoid of certain compounds which occur in others. In all the products examined, however, the first four of the above-mentioned compounds were invariably found to be present.

Very shortly after the appearance of the above communication a paper on the same subject was published by O. Hesse (*Annalen*, 1912, 388, 65). The results described in the latter paper, however, are such as would give the impression, at first sight, that the conclusions of Hesse and those of the present authors had very little in common. Some further explanation of the subject therefore appears desirable.

Hesse mentions as constituents of commercial chrysarobin the following substances: "Chrysophanol"* (chrysophanolanthranol); "emodinol" (emodinanthranol); the methyl ethers of both these substances; and a new substance, $C_{15}H_{12}O_4$, which is designated as chrysarobol. It is stated by Hesse, however, that of these five substances, only two, namely, "chrysophanol" (chrysophanolanthranol) and chrysarobol, had been isolated directly in a pure state from commercial chrysarobin, whereas all the constituents described by the present authors were directly isolated in a state of purity.

Chrysophanolanthranol has long been known to be a constituent of commercial chrysarobin, but chrysarobol has not been obtained by the present authors. This is doubtless due to the varying composition of the commercial product, since Hesse remarks that he

* It would appear unfortunate that Hesse should have employed the name chrysophanol for the anthranol of "chrysophanic acid," since the former name had already been employed by the present authors (*loc. cit.*, p. 292), and previously by Tschirch (*Arch. Pharm.*, 1911, 249, 222; and 1912, 250, 27), as the designation for pure "chrysophanic acid." Moreover, since Hesse himself (*Annalen*, 1899, 309, 32) and Jowett and Porter (T., 1902, 81, 1577) have previously applied the name "chrysarobin" to chrysophanolanthranol, the employment of yet a third name for this substance only adds to the confusion already existing.

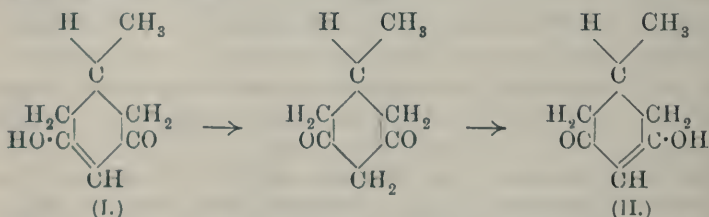
only obtained this new substance from the chrysarobin occurring in commerce in the years 1905 and 1906.

With regard to emodinanthranol (Hesse's "emodinol"), no doubt can be entertained that this was derived chiefly from the monomethyl ether of dehydroemodinanthranol * which was isolated and described by the present authors, since the material examined by Hesse had been heated with hydriodic acid. Hesse himself shows that he could not obtain "chrysophanol methyl ether" and "emodinol methyl ether" in a state of purity, and the evidence he adduces does not seem to justify the conclusion that they are present. In the material examined by the present authors, the former compound certainly did not occur, but proof of the presence of small amounts of the latter was obtained.

The statement made by Hesse that chrysophanolanthranol (Hesse's "chrysophanol") is insoluble in alkalis in the absence of air is incorrect. This substance dissolves fairly readily in 10 per cent. aqueous potassium hydroxide, yielding a bright yellow solution, which, on the admission of air, develops the deep red colour due to the formation of chrysophanol.

280. "Substituted dihydroresoreins. 1-Methyldihydroresorcin and 2-methyldihydroresorcin." By Charles Gilling.

1-Methyldihydroresorcin is a tautomeric substance, and it is suggested that this tautomerism prevents the existence of the two stereoisomeric forms, since it is apparent that I and II are mirror images of each other:



The replacement of the labile hydrogen atom by an ethyl group destroys this tautomerism, and the ethyl ether can accordingly be isolated in two distinct forms.

* In a footnote to his paper, added after the completion of the work, Hesse states that he has never observed the occurrence of the monomethyl ether of dehydroemodinanthranol described by the present authors, but this is obviously due to his having worked almost entirely with material which had been demethylated by means of hydriodic or hydrochloric acid. In all the commercial samples of chrysarobin examined by the present authors it was present to the extent of from 13.4 to 41.1 per cent.

2-Methyldihydroresorcin can be prepared from cresorcinol by reduction, but the product so obtained is impure, and it was only isolated in the form of crystalline derivatives.

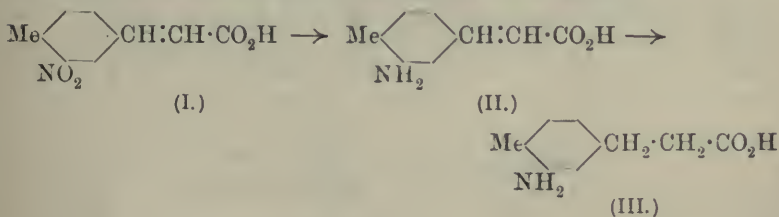
281. "Researches on the constitution of physostigmine. Part III. The formation of substituted indoles from *m*-4-xylidine, and the reduction of 3-nitro-*p*-tolyla acrylic acid." By Arthur Henry Salway.

In this investigation the author has described some experiments, which were conducted with the object of ascertaining whether Madelung's reaction for the preparation of substituted indoles from *o*-toluidides (*Ber.*, 1912, **45**, 1128, 3541) could be applied to acyl derivatives of *m*-4-xylidine, according to the scheme:



It has now been shown that aceto-*m*-4-xylidide readily yields 2:5-dimethylindole by this method. The reaction, however, was found not to be generally applicable, since 2:4-xylylsuccinamic acid, $\text{C}_6\text{H}_3\text{Me}_2 \cdot \text{NH} \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{CH}_2 \cdot \text{CO}_2\text{H}$, and its derivatives, which were of interest in connexion with the problem of the constitution of physostigmine, could not be converted into indoles without disruption of the molecule.

The reduction products of 3-nitro-*p*-tolyla acrylic acid (I) have also been described. It has been ascertained that the nitro-group of this substance is more readily attacked by reducing agents than the cinnamyl residue, so that the first product of the reaction is 3-amino-*p*-tolyla acrylic acid (II), which by further reduction is converted into β -3-amino-*p*-tolylpropionic acid (III):

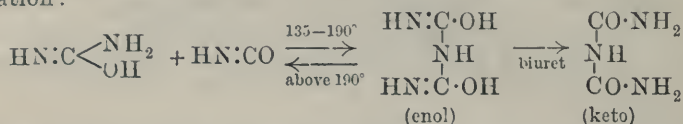


282. "Mechanism of the decomposition of carbamide and biuret by heat, and of the formation of ammeline." By Emi Alphonse Werner.

In continuation of work recently published (*T.*, 1913, **103**, 1010), a quantitative study of the decomposition of carbamide and biuret

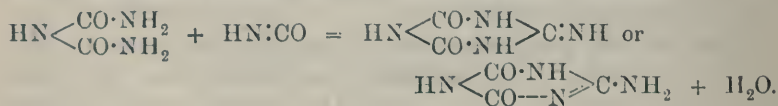
by heat has been made, the results of which have thrown new light on the mechanism of the progressive changes.

It was shown that the formation of biuret by the action of heat on carbamide is a reversible reaction in accordance with the equation:

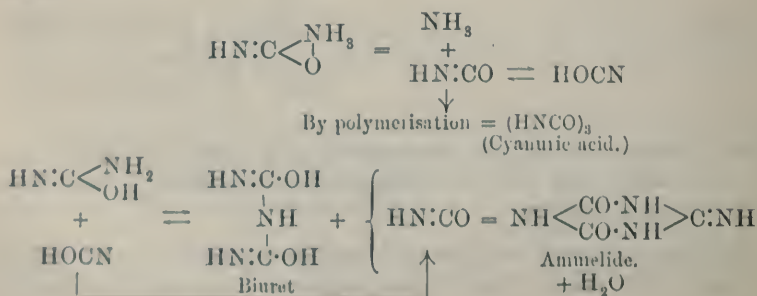


By heating pure anhydrous biuret for five minutes at 192° (m. p. 190°), as much as 30 per cent. of regenerated carbamide was extracted from the residue. The general idea that biuret decomposes directly into ammonia and cyanuric acid is therefore erroneous.

No evidence could be obtained of the formation of tricyano-carbamide, $\text{C}_3\text{N}_3(\text{NH} \cdot \text{CO} \cdot \text{NH}_2)_3$, described by Hantzsch and F. Hofmann (*Ber.*, 1905, **38**, 1010) as a product of the action of heat on carbamide; the properties of the substance described by them are identical with those of ammelide (cyanuric monamide), which has been long since recognised by Liebig and Wöhler and others as a product of the decomposition of carbamide. Proof was obtained that this compound originates from the further interaction of cyanic acid and biuret according to the equation:



and hence is also formed during the decomposition of biuret, but in smaller quantity, since the conditions are less favourable. Thus it was shown that the whole cycle of changes which takes place during the decomposition of carbamide and biuret by heat can be simply explained by (1) dissociation, and (2) instability and reactivity of nascent cyanic acid, as illustrated by the following scheme:



283. "Note on the mechanism of α -bromination in ketones."

By Arthur Lapworth.

H. Leuchs has recently found that, by bromination of an optically active ketonic acid, a monobromo-derivative is obtained which exhibits some optical activity. As the activity of both compounds is dependent on enantiomorphism in the arrangement of the atoms and groups around the α -carbon atom to which the bromine attaches itself, Leuchs concludes that the enolic form of the ketone could not have been an intermediate stage in the substitution process, and he suggests applying a similar test to active monalkylmalonic hydrogen esters (*Ber.*, 1913, **46**, 2438).

Leuchs's inference is not quite conclusive, for the facts admit of different interpretations; for example, if the ketonic acid, like other carboxylic acids, is to any extent associated, and substitution takes place in one part of a polymolecule only, then the remainder of the polymolecule may retain its enantiomorphous arrangement during enolisation of the first portion, and consequently the formation of a new "asymmetric" carbon atom in the latter would naturally lead to the formation of some excess, however small, of atoms of one sign. In other words, a "partial asymmetric synthesis" is possible.

The bromination of active α -methylbutyric acid has previously been studied by Schütz and Marekwald (*Ber.*, 1896, **29**, 59), and of β -phenylisobutyric acid by Lapworth and Lenton (*P.*, 1902, **18**, 35). In both instances the product was inactive.

284. "Studies in the diphenyl series. Part V. Derivatives and substitution products of the two isomeric *o*-dinitrobenzidines and synthesis of derivatives of benzerythrene." By John Cannell Cain, Albert Coulthard and Francis Mary Gore Micklethwait.

The authors have prepared a number of acyl and azo-derivatives of the two isomeric *o*-dinitrobenzidines (*T.*, 1912, **101**, 2298), and have submitted the two bases to the diazo-reaction.

3:3'-Dinitrobenzidine gives the corresponding disubstituted 3:3'-dinitrodiphenyl, but 3:5'-dinitrobenzidine, in those cases where copper is employed, gives derivatives of benzerythrene:



Of the numerous derivatives of the two bases that have been prepared, no two corresponding ones are identical.

285. "Harmine and harmaline. Part II. The synthesis of *iso*-harman." By William Henry Perkin, jun., and Robert Robinson.

A detailed description of work of which a preliminary account has already appeared (P., 1912, 28, 154).

ADDITIONS TO THE LIBRARY.

I. Donations.

Arup, *Paul Seidelin*. Industrial organic analysis. London 1913. pp. xii + 340. ill. 7s. 6d. net. (*Recd.* 23/10/13.)

From the Publishers: Messrs. J. & A. Churchill.

Asch, *W.*, and Asch, *D.* The silicates in chemistry and commerce. Including the exposition of a hexite and pentite theory and of a stereo-chemical theory of general application. Translated with critical notes and some additions by *Alfred B. Searle*. London 1913. pp. xx + 456. 21s. net. (*Recd.* 21/10/13.)

From the Publishers: Messrs. Constable and Company.

Beutel, *Ernst*. Bewährte Arbeitsweisen der Metallfärbung. Wien 1913. pp. viii + 88. M.2.—. (*Recd.* 30/8/13.)

From the Publisher: Wilhelm Braumüller.

Chemisches Zentralblatt. General Registers über die Jahrgänge 1902–1906, und 1907–1911, Teil II. Berlin 1907, 1913. 2 vols. pp. 1663, 645 to 2040.

From the Right. Hon. Sir Henry E. Roscoe, D.C.L., F.R.S.

Cohen, *Julius Berend*. Organic chemistry for advanced students. Vol. II. London 1913. pp. vii + 427. 16s. net. (*Recd.* 1/8/13.)

From the Publisher: Edward Arnold

Cumming, *Alexander Charles*, and Kay, *Sydney Alexander*. A text-book of quantitative chemical analysis. London 1913. pp. xi + 382. 7s. 6d. net. (*Recd.* 22/10/13.)

Gildemeister, *E.*, and Hoffmann, *Friedrich*. The volatile oils. Authorised translation by *Edward Kremers*. Vol. I. London 1913. pp. xiii + 677. ill. 20s. net. (*Recd.* 6/8/13.)

From Messrs. Schimmel and Co.

Harloff, *W. H. Th.*, and Schmidt, *H.* Plantation white sugar manufacture. Translated from the second Dutch edition by *James Pettigrew Ogilvie*. London 1913. pp. vii + 138. 7s. 6d. net. (*Recd.* 10/9/13.)

From the Translator.

Mackenzie, John E. The sugars and their simple derivatives. London 1913. pp. xvi + 242. ill. 7s. 6d. net. (*Recd.* 21/10/13.)

From the Publishers: Messrs. Gurney and Jackson.

Mennicke, Hans. Die quantitativen Untersuchungsmethoden des Molybdäns, Vanadiums und Wolframs, sowie deren Erze, Stähle. Legierungen und Verbindungen. Berlin 1913. pp. 231. M.8.—. (*Recd.* 16/9/13.)

From the Publisher: M. Krayn.

Porritt, Benjamin Dawson. The chemistry of rubber. London. London 1913. pp. vii + 96. 1s. 6d. net. (*Recd.* 4/7/13.)

From the Author.

Pranke, Edward J. Cyanamid. Manufacture, chemistry and uses. Easton, Pa. 1913. pp. vi + 112. \$1.25. (*Recd.* 2/8/13.)

From the Publishers: The Chemical Publishing Company.

Roscoe, The Right Hon. Sir Henry E., and Schorlemmer, Carl. A treatise on chemistry. Vol. II. The metals. New edition completely revised. London 1913. pp. xvi + 1470. ill. 30s. net. (*Reference.*)

From the Right Hon. Sir Henry E. Roscoe.

Royal Society of London. Catalogue of the Periodical Publications in the Library. London 1912. pp. viii + 455. 15s. net. (*Reference.*)

From the Royal Society.

Smith, Harold Hamel [Editor]. The fermentation of cacao. With which is compared the results of experimental investigations into the fermentation, oxidation, and drying of coffee, tea, tobacco, indigo, etc., for shipment. By the following authorities: *Axel Preyer, Oscar Loew, Fickendey, Schulte im Hofe, J. Sack, Geo. S. Hudson; and Lucius Nicholls.* London 1913. pp. lvi + 318. ill. 10s. net. (*Recd.* 1/9/13.)

From the Publishers: Messrs. John Bale, Sons and Danielsson.

II. By Purchase.

Abegg, Richard, and Auerbach, Friedrich [Editors]. Handbuch der anorganischen Chemie. Vol. I. Part ii. Leipzig 1913. pp. x + 904. M.26.—. (*Reference.*)

Barner, Jacob. Chymia Philosophica perfecte delineata. Noribergæ 1689. pp. [xiv] + 560 + [lvi]. (*Reference.*)

Chevreul, Michel Eugène. [Liste bibliographique des] Oeuvres scientifique de Michel Eugène Chevreul, 1806-1886. By *Godefroy Malloizel.* Paris 1886. pp. 298. (*Recd.* 18/10/13.)

Dorn, Gerhard. Chymisticum artificium naturæ, Theoricum et practicum. [In 3 parts.] 1568-69. pp. 156, [xvi] + 440 + [viii]. ill. (*Reference.*)

Ettmüller, Michael. Chimia rationalis ac experimentalis curiosa. Lugduni Batavorum 1684. pp. [viii] + 159. (*Reference.*)

Fürth, *Otto von*. Probleme der physiologischen und pathologischen Chemie. II. Band. Stoffwechsellchre. Leipzig 1913. M.23.—. (Recd. 18/9/13.)

Gildemeister, *E.*, and Hoffmann, *Friedrich*. Die aetherischen Oele. 2nd edition by *E. Gildemeister*. Vol. II. Leipzig 1913. pp. xviii + 713. M.20.—. (Recd. 1/10/13.)

Molinari, *Ettore*. Treatise on general and industrial organic chemistry. Translated from the 2nd Italian edition by *Thomas Henry Pope*. London 1913. 24s. net. (Recd. 6/10/13.)

Nazari, *Giovanni Battista*. Della Tramutatione metallica sogni tre, . . Nel primo d'i quali si tratta della falsa tramutatione sofistica : Nel secondo della utile tramutatione detta reale usuale : Nel terzo della diuina tramutatione detta reale Filosofica. Con un copioso Indice per ciascun sogno de gl' Auttori, & opre c'hanno sopra cio trattato. In Brescia 1572. pp. [viii] + 167 + [viii]. (Reference.)

Thurneisser, *Leonhardt*. Προκατάληψις oder Præoccupatio, Durch zwölff verscheidenlicher Tractaten, gemachter Harm Proben. Das 59 Buch. Franckfurt 1571. pp. [iv] + lxxxv + [ii]. (Reference.)

III. Pamphlets.

Anderson, *C.*, and Mingaye, *J. C. H.* Description and analysis of the Binda meteorite. (From the *Records of the Australian Museum*, 1913, 10.)

Bovie, *W. T.* A preliminary note on the coagulation of proteins by the ultraviolet light. (From *Science*, 1913, N.S. 37.)

— The temperature coefficient of the coagulation caused by ultraviolet light. (From *Science*, 1913, N.S. 37.)

Drucker, *Carl*. Molekularkinetik und Molarassoziation als physiko-chemische Grundvorstellungen. Leipzig 1913. pp. 33.

Eaton, *Bertie James*. Camphor from *Cinnamomum Camphora*, (The Japanese Camphor Tree). Cultivation and preparation in the Federated Malay States. (Fed. Malay States. Dep. of Agric. Bull., 1912, No. 15.)

— The preparation of plantation Para rubber. (Fed. Malay States. Dept. of Agric. Bull., 1912, No. 17.)

Fichter, *Fr.*, Stutz, *Karl*, and Grieshaber, *Fritz*. Ueber die elektrolytische Bildung von Harnstoff und von Acetamidin-nitrat. (From the *Verhandl. Naturforsch. Ges., Basel*, 1912, 23.)

Fischer, *Emil*, and Klemperer, *Georg*. Ueber eine neue Klasse von lipoiden Arsenverbindungen. (From the *Therapie der Gegenwart*, 1913.)

Hooper, *David*. The ash of the Plantain (*Musa sapientum*). (From the *J. and Proc. Asiatic Soc., Bengal*, 1912, 8.)

India. Report on the progress of Agriculture in India for 1911-12. Calcutta 1913. pp. 65.

Schröder, F. Ueber den Nachweis von weissem Phosphor in Zündwaren. (From the *Arch. K. Gesundheit*, 1913, 44.)

Odén, Sven. Der Kolloide Schwefel. (From the *Nova Acta Regiæ Soc. Sci. Upsala*, 1913, [iv], 3.)

Osterhout, W. J. V. Plants which require sodium. (From the *Bot. Gaz.*, 1912, 54.)

Sabatier, Paul. Die Hydrierung durch Katalyse. Leipzig 1913. pp. 20.

Tadokoro, T. Ueber die Enzymatischen Wirkungen der Frischen Nahrungs-und Genussmittel. (From the *J. Coll. Agric., Tohoku Imp. Univ., Sapporo, Japan*, 1913, 5.)

Vavon, Gustave. Réductions catalytiques en présence de noir de platine. Application a la transformation en alcools des aldéhydes et des cétones. Toulouse 1913. pp. 107.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on, or before, Monday, December 1st, 1913.

All persons who received grants in December, 1912, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Hon. Secretaries not later than Monday, December 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

PAPERS TO BE READ AT ORDINARY SCIENTIFIC MEETINGS.

A list of the papers to be read at each Ordinary Scientific Meeting will be advertised in the *Morning Post* on the Wednesday previous to the day of meeting, and will appear on the front page, at the top of extreme right-hand column.

LAWES AND GILBERT CENTENARY FUND.

It is proposed to erect at Rothamsted a Commemoration Laboratory to celebrate the centenary of the birth of Sir John Lawes in 1814 and of Sir Henry Gilbert in 1817. A sum of £12,000 is required for the purpose, but it is understood that if one-half of this amount can be raised by subscription, the other half will be forthcoming in the form of a grant. An appeal is therefore being issued for the sum of £6000. Subscriptions should be sent to the Secretary, The Rothamsted Experimental Station, Harpenden, cheques being crossed Robarts, Lubbock and Co.

At the next Ordinary Scientific Meeting on **Thursday, November 20th, 1913, at 8.30 p.m.**, the following papers will be communicated:

"The interaction of sodium amalgam and water." By H. B. Baker and L. H. Parker.

"The action of variously treated waters on sodium amalgam." By L. H. Parker.

"Some derivatives of oleanol." By F. Tutin and W. J. S. Naunton.

"Some derivatives of phorone. Part I." By F. Francis and F. G. Willson.

"The porosity of iron." By W. H. Perkins.

"The bleaching action of hypochlorite solutions." By S. H. Higgins.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29

No. 420.

Thursday, November 20th, 1913, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Messrs. R. E. Slade and S. C. Sastry were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Albert Frederick Calvert, Royston, Eton Avenue, N.W.

Behari Lal Das, 107/2/1, Manaharpukur Road, Kalighah, Calcutta.

Eric Russell Harrap, Maisemore, Ebury Road, Rickmansworth, Herts.

Oswald Ryle Horwood, M.A., M.R.C.S., L.R.C.P., Tunstall Rectory, Suffolk.

Dan Ivor James, M.A., B.Sc., Frondeg, Llandilo, Carmarthen-shire.

Alexander Williamson McLaren, 3, Hayfield Terrace, Langside, Glasgow.

Harold Edwin Temple, 239, Cashel Street, Christchurch, New Zealand.

Robert James Wright, M.A., c/o R. Burnett, Esq., 336, Pollok-shaws Road, Glasgow.

A Certificate has been authorised by the Council for presentation to ballot under Bye-law I(3) in favour of Mr. Bertie Mandel Welch, 80, Hunter Street, Sydney, N.S.W.

The PRESIDENT announced (1) that the bust of the Rt. Hon. Sir Henry Roscoe which was exhibited at the meeting had been presented to the Society by the friends and former students of Sir Henry Roscoe.

(2) That by request of the Council Messrs. Vieweg & Sohn have offered to sell the first volume of the "Literatur Register," by R. Stelzner, to Fellows of the Chemical Society at the reduced price of £3 10s. (original price £4 4s.), provided that not less than twenty copies are sold to Fellows of the Society. Those Fellows who desire to obtain a copy of the "Literatur Register" on these terms are requested to send in their names to the Honorary Secretaries.

The PRESIDENT referred to the meeting of the International Association of Chemical Societies which had been held in Brussels during September, 1913, and drew the attention of Fellows to the abbreviated report of the meeting which the Council have ordered to be printed in the Proceedings (see p. 325).

Of the following papers those marked * were read:

- *286. "Investigations on the dependence of rotatory power on chemical constitution. Part V. The simpler esters of the carbinols, $\text{CH}_3\cdot\text{CH}(\text{OH})\cdot\text{R}$." By Robert Howson Pickard and Joseph Kenyon.

The following homologous series of esters of normal aliphatic acids have been prepared and examined polarimetrically under various conditions: (i) the *esters* of *d*-methyl-ethylcarbinol; (ii) the *esters* of *d*-methyl-*n*-propylcarbinol; (iii) the *esters* of *d*-methyl-*n*-butylcarbinol; (iv) the *esters* of *d*-methyl-*n*-amylcarbinol; (v) the *esters* of *d*-methyl-*n*-hexylcarbinol; (vi) the *esters* of *d*-methyl-*n*-nonylcarbinol [these six series range from the acetates to the stearates]; (vii) the *acetates* and (viii) the *n*-*dodecoates* of the *d*-carbinols [methylethylcarbinol to methyl-*n*-undecylcarbinol].

Many of these esters (all of very simple constitution) exhibit anomalous dispersion when examined polarimetrically at temperatures above 150° or at various concentrations in solvents such as pyridine, benzene, or carbon disulphide.

- *287. "Co-ordination of rotatory powers for different wave-lengths, temperatures and solutions." (Preliminary note.) By Robert Howson Pickard and Joseph Kenyon.

The authors have already described the synthesis of thirty optically active carbinols of the general formula $\text{R}^1\cdot\text{CH}(\text{OH})\cdot\text{R}^2$,

and some seventy esters derived from some of them. These compounds have been examined polarimetrically for three wave-lengths (a) in the homogeneous state at different temperatures, and (b) in several solvents at various concentrations. It was found (see preceding paper) that many of these under certain conditions exhibited anomalous optically rotatory dispersion.

The attention of the present authors was therefore directed to a paper by H. E. Armstrong and E. E. Walker entitled "The Causes of Variation in the Optical Rotatory Power of Organic Compounds and of Anomalous Rotatory Dispersive Power" (*Proc. Roy. Soc.*, 1913, A, **88**, 388). In this paper it is suggested that anomalous dispersion is caused by the presence of two substances (in the actual cases considered of two isodynamic forms) having rotatory powers of opposite sign and different dispersive powers.

In the case of esters of such simple constitution as those described in the preceding paper, the suggested explanation of the anomalous dispersion seems feasible, however, only on the assumption of a change in the association of the esters, not only in the homogeneous state on increase of temperature, but also on solution in various solvents.

A "characteristic diagram" for *d*-*sec*.-octyl acetate was therefore constructed according to the method of Armstrong and Walker (*loc. cit.*). A reference line with slope of unity was drawn, and on it were plotted the various numbers representing the specific rotatory powers for mercury-green light. The numbers representing the specific rotatory powers for sodium-yellow and mercury-violet lights were then plotted on the ordinates passing through the points previously located on the reference line. The various points for the latter two lights were found to lie on two straight lines, and the diagram was similar in character to those for the substances of previously known anomalous dispersive power as drawn and described by Armstrong and Walker.

It is now found, however, that this same "characteristic diagram" can be used to co-ordinate the results of *all* the determinations of rotatory power of one of the two optically active forms of the hundred synthetical compounds previously described by the present authors; thus the numerical results (varying from +50 to -25) of the determinations of rotatory power for the three lights in different solvents at all concentrations and in the homogeneous state at different temperatures, not only of one compound, but of many (all of which are of very simple, but closely-related constitution), have been plotted on one diagram. In this the various values lie on three straight lines, which intersect above the zero-line, and not all at one point. The dispersions then appear

in the diagram as some function varying with the magnitude of the rotatory powers, thus co-ordinating the small, but very definite, differences in the dispersions of the homologous compounds which have been observed experimentally.

It cannot yet be said whether this co-ordination is due either (i) to the comparison of a large number of compounds which have very similar dispersive powers, or (ii) to the closely related constitutions of the substances.

This method of plotting appears to afford (in some cases at least) a means by which a derivative differing in sign from that of the optically active parent substance can be properly designated "*d*" or "*l*," and also a means of determining whether a change in configuration has taken place in the formation of a derivative.

DISCUSSION.

Sir W. RAMSAY suggested that the cause of rotation was ultimately in the direction of the circular motion of electrons within the molecule. A dextrorotatory substance, say, might have hydroxyl in the molecule, capable of repelling an electron, and causing it to rotate dextrorotatorily. On the other hand, if the hydroxyl be replaced by bromine, the bromine atom might have the property of attracting an electron and of reversing the direction of its rotation. This suggestion was made, not with any conviction of its applicability, but merely for consideration as to whether it was possible to obtain any clue to the fundamental reason of rotation.

***288. "The interaction of sodium amalgam and water."**

By Herbert Brereton Baker and Leslie Henry Parker.

Water distilled under special conditions has a visibly slower rate of action on sodium amalgam than ordinary distilled water. An apparatus was constructed to measure accurately the hydrogen evolved, and various samples of water were tested. The least active specimens of water were obtained by distillation from copper or platinum apparatus, especially on superheating the steam before the latter was condensed.

The rate of action was shown to be no function of the conductivity of the water used, but was found to depend largely on the pressure at which the reaction was conducted, increase of pressure causing the rate of action to diminish, and vice versa. Various explanations of this phenomenon were put forward and tested, but the only feasible one was the assumption of the presence of some impurity in minute quantity, which was volatile under the

conditions of ordinary distillation, but was destroyed on heating to redness. Experimental evidence was adduced which seemed to show that the only impurity which satisfied all the conditions was hydrogen peroxide, and the widely differing activities of various samples of water on sodium amalgam is ascribed to the presence of varying quantities of hydrogen peroxide.

***289. "The action of variously treated waters on sodium amalgam."
By Leslie Henry Parker.**

Further evidence was adduced in support of the explanation of the varying activity of different samples of water on sodium amalgam put forward by Baker and Parker (preceding paper).

Various metals were sealed up with a quantity of the inactive water for definite periods. Metals such as copper, mercury, etc., did not have much effect, whilst aluminium increased the activity of the water on sodium amalgam. This was shown to be in harmony with Traube's work on the wet oxidation of metals (*Ber.*, 1882, **15**, 670). Exposure to radium bromide also increased the activity. This is in accordance with the work of Kailan (*Monatsh.*, 1912, **33**, 1329).

DISCUSSION.

Dr. SENTER suggested that the results would probably come under the heading of over-voltage phenomena, the best-known example of which was the retarded action between pure zinc and sulphuric acid. Over-voltage at the boundary between solid and liquid appeared to be connected with surface tension, and it might be assumed that the active substance, whatever it might be, modified the surface tension.

With reference to the author's proof of the presence of hydrogen peroxide in tap water, tests depending on the liberation of iodine from iodides were rather untrustworthy, as in certain circumstances dissolved oxygen gave the reaction in question. The titanium dioxide test was trustworthy, and was extremely sensitive, as it was capable of detecting 1 part of peroxide in 50 million parts of water (compare Senter, *Trans. Faraday Soc.*, 1906, **2**, 142), and the fact that it was not given by the water in question appeared to render further investigation desirable. The effect of added hydrogen peroxide might be connected with the fact that this compound was readily decomposed at a mercury surface (Bredig); the evolution of oxygen would presumably disturb the very unstable equilibrium characteristic of over-voltage.

Dr. R. E. SLADE agreed that it was to be expected that hydrogen

peroxide would disturb the over-voltage at the surface of the amalgam in the manner suggested by Dr. Senter. He believed, however, that a very important factor was the existence of dust particles in the water, and quoted the work of G. N. Lewis on the potential of sodium amalgams in support of this. The experiment which Mr. Parker had just shown rather pointed to this theory, for in the tube of pure water the bubbles of hydrogen came off at a few points which moved about on the surface of the amalgam. Perhaps the superheating of the steam was an efficient way of removing particles of dust by destroying them or by causing them to adhere to the hot tube.

Dr. KEANE asked whether the influence of light had been studied in connexion with the experiments described, as this might have considerable effect both in regard to the production and decomposition of hydrogen peroxide.

In reply to Dr. Senter, Mr. PARKER said that no comparative experiments had been made as to the relative values of the tests for hydrogen peroxide: further experiments were in progress with the view of obtaining some light on the mechanism of the reaction. In reply to Dr. Keane, he also stated that no experiments had been tried on the influence of light on the reaction.

***290. "The polymerisation of cyanamide."**

By George Francis Morrell and Peter Burgen.

The polymerisation of cyanamide, under various conditions, both in the solid state and in solution, and also under the influence of catalysts has been quantitatively studied. With the pure substance itself only about 10 per cent. was found to have changed in six months, and in aqueous solution, even at elevated temperatures, the reaction proceeds comparatively slowly, many hours' heating at 100° being required to complete it. In absolute alcoholic solution the reaction-velocity is much further reduced. In all these cases the velocity-constant was not that of a bimolecular reaction, but equal amounts were found to be changed in equal intervals, except at great dilution, in which case a logarithmic curve was obtained. An ionic explanation may be advanced to explain these facts, the ions present in very small and, at first, practically constant concentration alone taking part in the change. The influence of acids and bases, such as sulphuric acid, ammonia, and sodium hydroxide, as catalysts produces an extremely marked acceleration, very small quantities reducing the period of half-change in aqueous solution at 100° from about twelve hours to as many minutes. Increasing quantities of sodium hydroxide produced

increasing acceleration up to a point corresponding with the addition of 0.25 equivalent, but the further addition brought about a slight retardation, so that a solution containing sodium cyanamide, although it polymerised much more rapidly than pure cyanamide (half period at 100°, thirty minutes, compared with twelve hours in the latter case), yet did not do so more quickly than one containing less than 1/30th of the amount of hydroxide. The velocity-constant of these reactions was found to be between that of a unimolecular and of a bimolecular reaction, which latter stage it would only reach, on the authors' hypothesis, at infinite dilution and complete ionisation.

DISCUSSION.

Dr. MORRELL, in reply to Dr. Forster, stated that the method found most satisfactory for isolating cyanamide from its sodium salt was to neutralise a well-cooled concentrated aqueous solution of the latter with oxalic acid. The precipitated sodium oxalate was filtered off, and the filtrate evaporated almost to dryness in a vacuum. From this residue the cyanamide was extracted with ether, in which other substances present were insoluble. It was finally purified by recrystallisation from the same solvent.

*291. "Some derivatives of oleanol."

By Frank Tutin and William Johnson Smith Naunton.

Oleanol, $C_{31}H_{50}O_3$, a crystalline substance from olive leaves (Power and Tutin, T., 1908, **93**, 896), has been further investigated. On oxidation with potassium permanganate it yields *oleanone*, $C_{29}H_{44}O_2(OH)_2$, which gives a *mono-* and *di-acetyl* derivative.

Oleanone, when heated with dilute acetic acid, undergoes a profound change, the reaction products containing a *substance*, $C_{50}H_{76}O_7(OH)_2$. An analogous change occurs when diacetyl-oleanone is heated with a mixture of acetic and hydrochloric acids. The *monoacetyl* derivative, $C_{50}H_{76}O_8(OH) \cdot CO \cdot CH_3$, thus produced, on hydrolysis with alkali, yields the above-mentioned dihydroxy-compound.

On oxidation with chromic acid, oleanone yields a *substance*, $C_{29}H_{41}O_3 \cdot OH$ (m. p. 275°), which, when heated for two hours with alcoholic alkali, gives an *isomeride*, melting at 315°. Both substances yield *monoacetyl* derivatives.

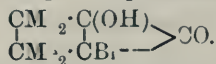
When oleanol itself is oxidised with chromic acid the above-mentioned substance, $C_{29}H_{42}O_4$ (m. p. 275°), is formed, together with a mixture of at least three *carboxylic acids*.

292. "Some derivatives of phorone. Part I."

By Francis Francis and Francis George Willson.

An investigation of some derivatives of phorone has been commenced by the study of a phorone dibromide obtained from the tetrabromide by the action of pyridine.

The most characteristic reaction of this dibromide is the ease with which it is converted by concentrated sulphuric acid into a crystalline derivative, a study of the oxidation and reduction products of which has led to the conclusion that it is 4-bromo-2:2:3:3-tetramethylbicyclo[0, 1, 2]pentan-1-ol-5-one,



The oxidation and reduction products were described; among the former is tetramethylsuccinic acid, and among the latter 1:1:2:2-tetramethylcyclopentan-4-one, a substance with properties curiously similar to those of camphor.

The derivative also gives rise on bromination to a *dibromide* possessing characteristic properties.

293. "The porosity of iron."

By William Hughes Perkins.

An attempt has been made to correct or confirm the conclusion of Friend that iron is slightly porous (T., 1912, 101, 50). It is concluded that only very small quantities of the alkalis, and therefore presumably of other salts, are retained under prolonged washing. The quantity of ammonia retained by iron after about fifteen to twenty minutes' washing is probably not more than about 0.0000001 gram per sq. cm.

294. "The bleaching action of hypochlorite solutions."

By Sydney Herbert Higgins.

Bleaching powder solution to which an excess of boric acid has been added has very energetic bleaching properties because the boric acid merely liberates hypochlorous acid from the hypochlorite, whereas an excess of hydrochloric acid produces free chlorine and a solution of very weak bleaching properties. If, however, calcium carbonate is added to the latter solution, hypochlorous acid is regenerated, and the bleaching properties are restored. The addition of hydroxides to hypochlorite solutions opposes the hydrolysis of the hypochlorite, and retards the bleaching action, whereas the addition of small quantities of acids assists

the hydrolysis and stimulates the bleaching action; the effect on the bleaching properties of the solution is due to the active mass of the free hypochlorous acid present, being in the one case reduced and in the other augmented. Even in the presence of a large excess of hydroxides the solutions have a small bleaching effect, which is probably due to a small amount of hypochlorous acid being still present in solution in spite of the opposition of the hydroxide to the hydrolysis of the metallic hypochlorite. All the experiments point to the conclusion that hypochlorite solutions entirely owe their bleaching properties to the free hypochlorous acid present in solution. Sometimes there is a secondary reaction between the hypochlorous acid and any neutral chloride present, producing nascent chlorine of energetic bleaching properties (P., 1912, 28, 130), but the main action is one of direct oxidation by the hypochlorous acid. During the bleaching action chlorides are produced by the reduction of the hypochlorites, but the stimulating effect of chlorides thus produced on the bleaching action is negligible.

295. "Guaiacum resin as a reagent for the detection of oxydases and of minute traces of copper." By William Ringrose Gelston Atkins.

In order to ascertain how far traces of metals might vitiate tests for oxydases by guaiacum resin, a series of experiments was carried out to determine the limits of sensitiveness of the reaction towards certain salts. Adopting the methods usual in water analysis, it was found that very minute amounts of copper salts or of potassium permanganate may be detected by this test. Accordingly it is brought forward as a reaction of utility in water analysis. Below are recorded the limits of sensitiveness of the reaction, expressed in grams per c.c. Copper as sulphate, 2×10^{-9} to 2×10^{-8} . Potassium permanganate, 4×10^{-8} . Potassium dichromate, 1×10^{-7} . Iron, as ferrous sulphate, 1×10^{-6} , as ferric sulphate, 1×10^{-6} . Lead as acetate, 6×10^{-6} . Nitric acid, 2×10^{-5} . Manganese as sulphate, 8×10^{-4} . In each case a few drops of hydrogen peroxide were added, as well as a very dilute solution of the reagent. Traces of chlorides were also present, and play an important part.

296. "The absorption spectra of various derivatives of pyridine, piperidine and piperazine in solution and as vapours." By John Edward Purvis.

The absorption spectra of a number of the derivatives of pyridine, piperidine, and piperazine, both in solution and in the

vaporous condition, have been investigated. The general results show that, besides the nature of the molecule, the type, the number, and the orientation of the side-chains influence the production of the narrow vapour bands; and that, when these bands disappear, the remaining bands are generally comparable with the solution bands.

297. "Derivatives of *p*-iodoaniline."

By Frederick Daniel Chattaway and Alfred Bertie Constable.

The ease with which chlorine and bromine substitute arylamines has led to a very complete knowledge of the simpler derivatives which they form, but comparatively few of the corresponding iodine compounds have been prepared on account of the difficulty of effecting iodine substitution and the readiness with which the iodoanilines decompose.

The conditions necessary to obtain a good yield of *p*-iodoacetanilide, and from it to prepare *p*-iodoaniline, were described. The aniline having been obtained in quantity, a number of its simpler derivatives have been prepared.

298. "The interaction of tetranitromethane and compounds containing centres of residual affinity." (Preliminary note.) By Ernest Magowan Harper and Alexander Killen Macbeth.

The work was undertaken to investigate the colours developed on adding tetranitromethane to various substances. Ostromisslensky (*J. pr. Chem.*, 1911, [ii], **84**, 349) has recorded such effects with aromatic amines and also with aliphatic compounds containing the ethylenic double linking. Clarke, Macbeth, and Stewart (this vol., p. 161) have shown that these are only particular cases of a more general phenomenon. Colours have been obtained with organic sulphides, iodides, phosphines, amino-compounds, etc.

The method employed was to photograph tetranitromethane in an alcoholic solution of the substance of constant strength. Tetranitromethane itself gives no colour in dry alcohol. With the sulphides a yellow colour is produced on mixing the solutions, but the absorption spectrum does not differ greatly from that of tetranitromethane. The colour deepens on keeping, and after some time the spectrum undergoes a great change. A band is developed in the region $1/\lambda$ 2800—2900; thus tetranitromethane with *N*/10-pentamethylene sulphide after fourteen hours shows a band the head of which is at $1/\lambda$ 2850 in the log-thickness 35 of *N*/100,000-solution.

With compounds containing an ethylenic double bond a similar

band is obtained; thus tetranitromethane with *N*/10-amylene after five days gives a band the head of which is at $1/\lambda$ 2850 in the log-thickness 32 *N*/100,000-solution.

Similar bands are obtained with sulphur compounds other than the sulphides (ethyl mercaptan, etc.) and with various aliphatic amino-compounds, the band development being exceptionally rapid in these cases.

In most cases the penetration of the band increases with time; thus:

	Band head.	Log-thickness <i>N</i> /100,000.	Time.
<i>N</i> /10-amylene	$1/\lambda$ 2850	32	5 days
<i>N</i> /10-amylene	$1/\lambda$ 2850	26	10 "
<i>N</i> /10-pentamethylene sulphide	$1/\lambda$ 2850	33	2 "
<i>N</i> /10-pentamethylene sulphide	$1/\lambda$ 2850	28	5 "

It appears that the solvent plays a very important part in the action. In light petroleum no band was obtained with tetranitromethane and amylene. The spectrum after five days and after fourteen days was the same.

Further, it would appear that there is in this way a means, not only of detecting, but also of comparing, the residual affinities of different substances; thus the different sulphides give bands of different penetrations in equal times, for example:

<i>N</i> /10-pentamethylene sulphide...	head of band	log-thickness	28	<i>N</i> /100,000	5 days
<i>N</i> /10-propyl sulphide.....	" "	" "	30	" "	5 "
<i>N</i> /10-thioxan	" "	" "	31	" "	5 "

A similar effect holds in the case of other classes of compounds.

With regard to the nature of the reaction, nitromethane was substituted for tetranitromethane with negative results. Investigations are being continued with other mononitro-compounds, in which the hydrogen atoms are replaced by chlorine and other electronegative atoms. Dinitro- and trinitro-compounds are also being substituted. The effect of introducing electronegative atoms into the molecule containing the centre of residual affinity is also being studied.

299. "The relative activities of certain organic iodo-compounds with sodium phenoxide in alcoholic solution. Part III. The temperature-coefficients." By David Segaller.

The velocity-coefficients of the following alkyl iodides, methyl, ethyl, propyl, isopropyl, butyl, isobutyl, *sec*.-butyl, *tert*.-butyl, amyl, isoamyl, *sec*.-amyl, hexyl, *sec*.-hexyl, heptyl, *sec*.-heptyl, octyl, *sec*.-octyl, and cetyl iodides have been measured with sodium

phenoxide in alcoholic solution at four different temperatures and the temperature-coefficients determined.

It is found that the results obtained are in good agreement with the equation of Arrhenius (*Zeitsch. physikal. Chem.*, 1889, **4**, 226). The results show that the relative activities of the alkyl iodides are approximately independent of the temperature.

300. "Resolution of α -anilinostearic acid."

By Henry Rondel Le Sueur.

α -Anilinostearic acid has been resolved into its optically active components by crystallisation of its *l*-menthylamine salt.

d- α -Anilinostearic acid melts at 129—130°, and has $[\alpha]_D^{19} + 34.7^\circ$ in solution in pyridine, and $[\alpha]_D^{40} + 18.6^\circ$ in solution in alcohol. The *l*- α -acid has also been isolated, and its properties are the same as those of its dextro-isomeride.

301. "The conversion of *d*-glucosamine into *d*-mannose." (Preliminary note.) By James Colquhoun Irvine and Alexander Hynd.

In previous communications (P., 1912, **28**, 54; T., 1912, **101**, 1128), the authors have already described the conversion of *d*-glucosamine into *d*-glucose. They have now succeeded, by a process which on first inspection seems more direct, in transforming the amino-sugar into *d*-mannose.

Methylglucosamine hydrochloride, when gently warmed with excess of benzaldehyde, passes gradually into solution when the liquid is saturated with dry hydrogen chloride. The product of this reaction is *benzylidenemethylglucosamine hydrochloride* (m. p. 205° with decomposition; $[\alpha]_D^{20} - 54.4^\circ$ in methyl alcohol), which is formed by condensation of the aldehyde with two hydroxyl groups of the sugar, and is thus comparable with the benzylidenemethylglucoside described by Alberda van Ekenstein. The compound is exceedingly unstable towards acids, and, when acted on by silver nitrite, loses not only the amino-group, but also the benzylidene residue and the glucosidic group. Chitose is thus the ultimate product of the reaction.

In order to avoid this disruption of the molecule, the amino-group was removed by the addition of excess of sodium nitrite in dilute aqueous solution. In this way the reaction of the system was kept continuously alkaline, and, although the glucosidic group was eliminated, the hydrolysis of the benzylidene residue was avoided, and thus chitose formation was excluded. During the reaction, nitrogen was vigorously evolved, and a sparingly soluble

product was rapidly precipitated. This proved to be a derivative of a reducing sugar, and was characterised as *monobenzylidene-mannose* (m. p. 144—145°; $[\alpha]_D^{20} -22.4^\circ$ in acetone). As the reducing group of the parent aldose is unsubstituted in this compound, the substance represents a new type of sugar derivative. On treatment with very dilute hydrochloric acid, the compound was easily hydrolysed, with the formation of *d*-mannose, which was identified by determination of the specific rotation and by conversion into crystalline derivatives, such as methylmannoside and mannoseanilide.

The individual steps of the process outlined above appear to proceed practically quantitatively, and are summarised below:

d-Glucosamine \rightarrow methylglucosamine hydrochloride \rightarrow benzylidenemethylglucosamine hydrochloride \rightarrow benzylidenemannose \rightarrow *d*-mannose.

It was shown that the formation of *d*-mannose as the final product cannot be attributed to the well-known action of alkali in effecting the conversion of closely related reducing sugars. Glucosamine may thus be converted into either *d*-glucose or *d*-mannose, and in one of the two processes a change of the nature of a Walden inversion must take place. The evidence at present available indicates that the change in configuration probably occurs during the decomposition of benzylidenemethylglucosamine by nitrous acid, and there seems no necessity to modify the claim made in a previous paper (*loc. cit.*) that glucosamine is a derivative of *d*-glucose.

302. "The mechanism of denitrification" By William Hulme.

A series of experiments, conducted with a view to investigate the mechanism of denitrification, showed that this reduction might be divided into two parts: namely, (1) the bacterial reduction, and (2) the enzymatic reduction.

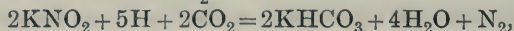
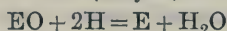
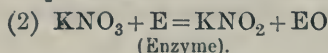
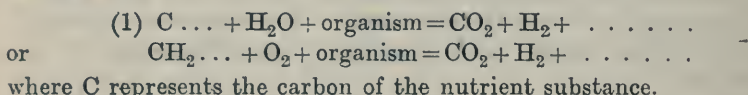
The fermentation of similar media, one with and the other without potassium nitrate, under anaerobic conditions, showed the gas evolution to consist of nitrogen (98 per cent.) and carbon dioxide from the nitrate-containing medium, and of hydrogen (70 per cent.) and carbon dioxide from the nitrate-free medium. A medium containing only a very small percentage of nitrate evolved nitrogen and carbon dioxide as long as nitrate and nitrite obtained in the solution, but hydrogen and carbon dioxide appeared as soon as these had disappeared; thus the chemical agent by which the organism reduces the nitrate is nascent hydrogen.

The media were tested for enzyme action by precipitation with

alcohol, drying, dissolving in water, and Chamberland-filtration, measured quantities of this solution being added to small quantities of a sterilised 1 per cent. solution of potassium nitrate, and the nitrite produced being measured. The results showed a considerable reduction with the "product" obtained from the nitrate-containing flasks, whilst that obtained from the nitrate-free flasks was devoid of this reducing power.

These results were confirmed by a second series of experiments, in which the fermentation took place aerobically. The enzyme solutions in all cases were not affected by boiling.

The mechanism of denitrification may be, therefore, represented as follows:



thus accounting for the large percentage of nitrogen in the gases evolved from the nitrogen-containing flasks.

303. "The catalytic activity of acids. Evaluation of the activities of the hydrogen ion and the undissociated acid." By Harry Medforth Dawson and Frank Powis.

The catalytic activity of a series of acids has been examined by measurements of the velocity with which acetone passes from the ketonic to the enolic form in aqueous solutions of determinate acid concentration. The results obtained are entirely at variance with the theory that the catalysing activity of an acid is determined by its hydrogen-ion concentration, for the ratio of the reaction-velocity to the ionic concentration varies to a large extent when the concentration of the acid is changed. The observations are, however, in good agreement with the view that both the non-ionised and ionised forms of the acid take part in the acceleration of the reaction, the actual catalytic effect being additively composed of the effects due to the two components.

The activity of the non-ionised acid diminishes rapidly as its tendency to ionise decreases; this is clearly shown by the following numbers, which express the activities in terms of that of the hydrogen ion: hydrochloric, 1.77; dichloroacetic, 0.50; $\alpha\beta$ -dibromopropionic, 0.152; chloroacetic, 0.056; acetic, 0.0034. As yet it does not seem possible to say whether these ratios are independent of the nature of the catalysed reaction.

304. "The configuration of the doubly-linked nitrogen atom. Optically active salts of the semicarbazone and benzoylphenylhydrazone of *cyclohexanone-4-carboxylic acid*." By William Hobson Mills and Alice Mary Bain.

The method which the authors used in order to investigate the configuration of tervalent nitrogen in the oximino-group (T., 1910, 97, 1866) has been further employed for the examination of the configuration of the doubly-linked nitrogen in the hydrazone group, $\text{:N}\cdot\text{NR}_1\text{R}_2$. *cycloHexanone-4-carboxylic acid benzoylphenylhydrazone* has been obtained in an optically active form by crystallisation of its *quinine* salt from dilute methyl alcohol. The sodium salt obtained by treating the quinine salt with sodium hydroxide was strongly dextrorotatory, having $[\text{M}]_D 238.6^\circ$.

Dextrorotatory salts of *cyclohexanone-4-carboxylic acid semicarbazone* (W. H. Perkin, T., 1904, 85, 427) were obtained similarly with the aid of morphine, the molecular rotations observed varying from $[\text{M}]_D 37.8^\circ$ to 27.9° in different preparations.

The active salts of both compounds showed marked autoracemisation on keeping, the loss of activity being much more rapid in the case of the semicarbazone than in that of the benzoylphenylhydrazone. The autoracemisation was checked by the addition of alkali hydroxides, sodium and potassium hydroxides being much more effective than ammonia. On acidification the activity in both cases instantly disappeared. These results can only be satisfactorily explained by regarding the molecular asymmetry of these compounds as being of the centro-asymmetric type, and due to the fact that when the carbonyl oxygen of the symmetrical keto-acid is replaced by the hydrazone residue, $\text{:N}\cdot\text{NR}_1\text{R}_2$, the $\cdot\text{NR}_1\text{R}_2$ group takes up a position outside the original plane of symmetry of the keto-acid. Accordingly, in these hydrazones, the three valencies of the doubly-linked nitrogen atom do not lie in one plane, but are directed along the three edges of a trihedral angle.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Cahen, *Edward*, and Wootton, *William Ord*. The mineralogy of the rarer metals. A handbook for prospectors. London 1912. pp. xxviii + 211. 6s. net. (*Recd.* 11/11/13.) From the Authors.

Royal Society of London. The celebration of the two hundred and fiftieth anniversary, July 15-19, 1912. London 1913. pp. iv + 128. (*Reference.*) From the Royal Society.

Solaro, Alessandro. Studio microscopico e chimico pel riconoscimento delle fibre vegetali, lane, peli, pelliccie, sete naturali, sete artificiali. Milano 1914. pp. 432. ill. L. 25. (*Recd.* 1/11/13.)

From the Publisher : Ulrico Hoepli.

Thorpe, Sir Edward. A dictionary of applied chemistry. Revised and enlarged edition. Vol. V. London 1913. pp. viii + 830. ill. 45s. net. (*Reference.*)

From the Publishers : Messrs. Longmans, Green and Co.

II. By Purchase.

Beringer, Cornelius, and Beringer, John J. A text-book of assaying, for the use of those connected with mines. 13th edition. London 1913. pp. xvi + 459. ill. 10s. 6d. net. (*Recd.* 20/11/13.)

Butler, D. B. Portland cement, its manufacture, testing, and use. 3rd edition. London 1913. pp. x + 458. ill. 16s. net. (*Recd.* 20/11/13.)

Kempf, Richard. Tabelle der wichtigsten organischen Verbindungen geordnet nach Schmelzpunkten. Braunschweig 1913. pp. xi + 135. M. 9.—. (*Recd.* 20/11/13.)

Kremann, R. The application of physico-chemical theory to technical processes and manufacturing methods. Translated by *Harold E. Potts* and edited by *Albert Mond*. London 1913. pp. xv + 212. ill. 8s. 6d. net. (*Recd.* 20/11/13.)

Lewkowitsch, Julius. Chemical technology and analysis of oils, fats, and waxes. 5th edition, entirely rewritten and enlarged. Vol. I. London 1913. pp. xxiii + 668. ill. 25s. net. (*Recd.* 20/11/13.)

Mellor, Joseph William. A treatise on quantitative inorganic analysis. With special reference to the analysis of clays, silicates, and related minerals. Being Vol. I of a Treatise on the ceramic industries. London 1913. pp. xxxi + 778. ill. 30s. net. (*Recd.* 20/11/13.)

Mitchell, C. Ainsworth. Mineral and aerated waters. London 1913. pp. xiii + 227. ill. 8s. 6d. net. (*Recd.* 20/11/13.)

Werner, Alfred. Neuere Anschauungen auf dem Gebiete der anorganischen Chemie. 3rd edition. Braunschweig 1913. pp. xx + 419. M. 11.—. (*Recd.* 20/11/13.)

Willstätter, Richard, and Stoll, Arthur. Untersuchungen über Chlorophyll, Methoden und Ergebnisse. Berlin 1913. pp. viii + 424. ill. M. 18.—. (*Recd.* 20/11/13.)

At the next Ordinary Scientific Meeting on **Thursday, December 4th, 1913, at 8.30 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated:

“Action of sulphuric acid on copper.” By the late J. T. Cundall.
(To be communicated by Sir William Ramsay.)

“Reactions which occur when glycerol and oxalic acid are heated together whereby formic acid and allyl alcohol are produced.” By F. D. Chattaway.

“The rotatory dispersive power of organic compounds. Part V. A comparison of the optical and magnetic rotatory dispersions in some optically-active liquids.” By T. M. Lowry, R. H. Pickard, and J. Kenyon.

“Organic derivatives of silicon. Part XX. Some condensation product of dibenzylsilicanediol.” By R. Robison and F. S. Kipping.

“Relation between chemical constitution and depth of colour of dyes.” By E. R. Watson.

“Dyes derived from quercetin.” By E. R. Watson and K. B. Sen.

“An improved form of apparatus, based on the Landsberger-Sakurai process, for the determination of molecular weight.” By W. E. S. Turner and C. T. Pollard.

“The rotation of optically active derivatives of succinic acid in aqueous solutions of inorganic salts. Part I.” By G. W. Clough.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, December 4th, 1913.

Advani, Parmanand Mewaram,
Karachi, India.

Lecturer in Chemistry and Physics, Dayaram Jethmal Sind College, Karachi, India. I have taken the M.A. and B.Sc. degrees of the Bombay University, and have been a lecturer in Chemistry and Physics at the D. J. Sind College since 1909. I was studying at the Indian Institute of Science for one term last year in the General Chemistry department, and mean to work there from time to time under the guidance of Dr. Travers and others.

Morris W. Travers.

H. E. Watson.

Norman Rudolf.

J. J. Sudborough.

Francis L. Usher.

Askew, Richard Watson, B.A.

“Brierley,” Chelmsford Road, Durban.

At present, I am in the employ of Kynoch, Limited, Umbogintwini, Durban. Within a period of three months from the present time, I will have completed a special practical training in the Chemical and Explosive Works. During this experience, I researched on Nitre-cake with a view to its practical uses. Previous to this training, I graduated at the Cape of Good Hope University in Pure Mathematics, Applied Mathematics, and Chemistry. The examination was both theoretical and practical. The Inter. B.A. included Physics. The other subjects ranged on the Mathematical and “Arts” side.

W. E. Martin.

A. T. Cocking.

H. H. Dodds.

A. B. Tonkin.

B. M. Nurbeth.

J. S. Jamieson.

A. M. Neilson.

Badami, Sankar Rao B.,

Badami House, Hulsurpet, Bangalore.

Research Student in the Indian Institute of Science, Bangalore, India. Master of Arts in Chemistry of the University of Madras.

M. W. Travers.

J. J. Sudborough.

H. V. Krishnayya.

H. E. Watson.

A. K. Yegna Narayan.

D. D. Kanga.

Bailey, Alan Milsom,

Lanhill, Chippenham, Wilts.

Analytical Chemist. Associate of the Institute of Chemistry. Late of the Government Laboratory, London, and of the Govt. Analyst's Office, Singapore.

James C. Philip.

H. Vincent A. Briscoe.

M. O. Forster.

F. P. Dunn.

G. T. Morgan.

Bate, Stanley Charles,

50, Alexandra Road, Upper Norwood, London, S.E.

Chemist in the Inspection Dept., Woolwich Arsenal. Bachelor of Science, London (1st Hons. in Chemistry). Associate of the Institute of Chemistry.

Oliver Trigger.

F. P. Dunn.

A. Vincent Elsdon.

James C. Philip.

H. F. Harwood.

Bateman, Alan Hamilton,

12, Chadwick Road, Leytonstone, Essex.

Scientific and Technical Chemist, and Student of the Institute of Chemistry. Two and a-half years' study, and afterwards (for a short period) Assistantship, in consulting and technical research laboratory; has matriculated, London University, and desires to have access to the latest scientific literature, including the Chemical Society's *Transactions* and *Proceedings*; also wishes to attend the Society's meetings, and make use of the library.

Edward Bevan.

A. Chaston Chapman.

C. F. Cross.

Otto Hehner.

Charles E. Cassal.

J. Kear Colwell.

Berlein, Charles Maurice,

Cross Oak, Berkhamsted,

Research Chemist. Honours in Chemistry at Oxford (B.A.). Eighteen months in Berlin under Emil Fischer. At present, Research

Chemist to "New Oil Refining Process, Ltd." Wish to make use of Society's library and to attend meetings.

Allan F. Walden.	N. V. Sidgwick.
Bertram Lambert.	E. Lawson Lomax.
W. B. Shaw.	W. H. Perkin.

Vivian B. Lewes.

Bicknell, Arthur, B.Sc.,
Balliol College, Oxford.

Research Student. Manchester University, B.Sc. Hons.

Harold B. Dixon.	Norman Smith.
Arthur Lapworth.	H. F. Coward.

W. H. Perkin.

Blaxter, Augustus Pearce Llewellyn,
"Chidham," Potters Bar, Middlesex.

Chemical Engineer. B.A. (Cantab. 1913). Natural Science Tripos,
Part I., 2nd class in Chemistry.

R. H. Adie.	F. E. E. Lamplough.
William Ramsay.	Geo. Chaloner.
Charles T. Heycock.	T. W. Firth Clark.

Bose, Adhor Krishna,
90, Musjeed Baree Street, Calcutta.

Assistant Chemist, Indian Tea Association. Formerly an assistant in the laboratory attached to the Industrial Section of Indian Museum under the Economic Botanist of the Botanical Survey Dept., Government of India, and subsequently under the Imperial Agricultural Chemist at Pusa Research Institute. At present, assistant to the Chief Scientific Officer, Indian Tea Association, Indian Museum.

David Hooper.	Jatindranath Sen.
P. H. Carpenter.	Dhirendranath Mitra.

Tin Kari Ghose.

Bramley, Arthur,
19, Cambridge Road, Barnes, London, S.W.

Research Chemist. B.Sc. (London), Honours in Chemistry; A.R.C.S in Chemistry; A.I.C. Joint author of a paper, "The Reaction between Ferric Salts and Thiocyanates," *J.C.S.*, 1913.

James C. Philip.	H. Brereton Baker.
B. Mouat Jones.	P. W. Robertson.

H. Vincent A. Briscoe.

Brearley, Arthur Joseph,
13, Victoria Terrace, Exeter.

Senior Science Master, Exeter School, Exeter. B.A. (Cantab.);

Nat. Sc. Tripos, Part I., First Class ; Nat. Sc. Tripos, Part II., Second Class. Science Master, Exeter School.

W. J. Pope.

Charles T. Heycock.

W. J. Sell.

F. W. Dootson.

W. H. Mills.

Butler, George Bernard,

10, Malvern Street, Elswick Road, Newcastle-on-Tyne.

Analytical Chemist. 1907 : Passed Durham and London Matriculation Examinations. 1907-8, 1908-9 : Student (Newcastle Corporation Exhibition Scholar) at Armstrong College, Newcastle-on-Tyne. 1908 : Passed Durham Intermediate Science Examination. 1909-10, 1910-11 : Student (private) under J. W. Patterson, F.C.S., and G. Palmer, B.Sc., F.C.S., at the West Hartlepool Technical College. 1913 : Chief Steel Laboratory Chemist at Messrs. Palmer's Shipbuilding and Iron Co., Ltd., Jarrow-on-Tyne.

P. Phillips Bedson.

J. A. Smythe.

F. C. Garrett.

J. W. Patterson.

Aq. Forster.

Gilbert Palmer.

J. H. Paterson.

Campbell, Bertram,

Beechover, Manor Avenue, Grimsby.

Research Student in the Dept. of Inorganic Chemistry at the Imperial College of Science and Technology. B.Sc. (Hons. Chem.), London. A.I.C.

H. Brereton Baker.

C. E. Sladden.

F. P. Dunn.

A. T. King.

P. W. Robertson.

Campbell, Norman Phillips,

Trinity College, Kandy, Ceylon.

Educational Missionary. Sometime Bracken burg Scholar in Natural Science, Balliol College, Oxford. 1st Class Honours (Chemistry) Schol. Nat. Sci. Joint author with H. B. Hartley of "The Solubility of Iodine in Water" and "The Preparation of Pure Water," published in the *Journal* of the Chemical Society.

H. Brereton Baker.

P. W. Robertson.

B. Mount Jones.

H. B. Hartley.

D. H. Nagel.

Carter, Frederick George,

Amritsar, Punjab, India.

Manager, Amritsar Distillery (for the Government of India). 1st Class Honours Grade, Brewing, City and Guilds, 1891 ; 3 years Assist-

ant to the Director, Central Excise Laboratory, Kasauli Government of India. Publication: "The Possibilities of Sugar Manufacture in the Punjab," with special analyses of the various kinds of sugar-canes grown in the Punjab.

E. Grant Hooper.

Francis J. H. Tate.

J. Connah.

Thos. J. Cheater.

J. Holmes.

Chowdry, Santi Pada,

Umaria, C.I.

Asst. Chemist. (Worked in Mr. D. Hooper's Laboratory in the Indian Museum, Calcutta, under him for two years.) Asst. Chemist, Economic Research Laboratory, Rewa State Industries, Umaria, C.I.

David Hooper.

Jatindranath Sen.

W. A. Freymuth.

Haradhan Ray.

Surendra Nath De.

Clark, Francis William,

35, Wilmington Square, London, W.C.

Chemist. Assistant chemist to the City of London Electric Lighting Co., Ltd., since 1906. Student at Northern Polytechnic and Sir John Cass Technical Institute, 1907 to 1911. Have Board of Education Certificates up to Stage III. Inorg. and Organic Chemistry, and have passed London Matriculation.

Chas. G. Cutbush.

H. Burrows.

Charles A. Keane.

George Senter.

G. Francis Morrell.

Coleman, Herbert Stoddard,

14, Dunsford Road, Bearwood Road, Smethwick.

Electrochemical Engineer and Traveller. Several years' experience in Manufacturing and Analytical Chemistry as Works Chemist, and finally as "General Works Manager," of Chemical Works. Also Supervising Chemist and Electrician, and at present acting as Technical Electrochemical Engineer. Honours in Chemistry and Metallurgy. Honours in Electrometallurgy, C.G.L. Institute. Registered Teacher in Electrometallurgy, C.G.L. Institute. Member of the Faraday Society.

Arthur Adams.

Samuel Field.

Jno. W. Alcock.

A. R. Gower.

H. S. Shorthouse.

Drakeley, Thomas James,

36, Mitchell Street, Newtown, Wigan.

Lecturer in Chemistry. Lecturer in Chemistry at the Wigan and

District Mining and Technical College. Two years course at University College, London, under Sir William Ramsay and Prof. J. N. Collie; 1st. class B.Sc. (London) 1911, conferred 1912.

E. B. Naylor.

William Ramsay.

J. Norman Collie.

Frank E. Weston.

Samuel Smiles.

Leslie Chas. W. Jenkins.

Eldin, Mohamed Shams,

University of Manchester.

Research Student in Chemistry. Lecturer in Chemistry (designate) in The Medical School, Cairo. B.Sc. Manch. University in Chemistry and Physics, 1912. Engaged in research in Organic Chemistry.

Harold B. Dixon.

E. Hope.

Ch. Weizmann.

A. Lapworth.

W. H. Perkin.

Fuller, Cyril Duncan,

62, Hill Street, Totterdown, Bristol.

Analytical Chemist. Obtained elementary chemical knowledge and certificates at Merrywood Higher Grade School. Demonstrator in Chemistry and Metallurgy, Merchant Venturers' Technical College, Bristol, for five years. Technical Chemist in large Oil and Colour works for five years. Student, Institute of Chemistry. Undergraduate, Bristol University. Now appointed Works Manager.

J. Wertheimer.

F. W. Rixon.

Francis E. Needs.

Francis Francis.

M. W. Jones.

James W. McBain.

Gair, Charles John Dickenson,

39, Cranston Road, Forest Hill, London, S.E.

Analytical Chemist. Studied Chemistry under Professor Meldola at Finsbury Technical College. Analyst to South Metro. Gas Co. for 10 years. Communicated two papers to the Society of Chemical Industry on Improved Methods of Estimating Naphthalene in Coal Gas.

Raphael Meldola.

B. H. Buttle.

Arthur J. Hale.

W. W. O. Beveridge.

E. V. Evans.

Gibson, Stanton,

28, Lordship Park, London, N.

Works Chemist to a firm engaged in manufacturing Celluloid substitutes, etc., from Casein. Studied 4 years as an Internal Student of London University: obtained 1st class Honours in Chemistry in Final B.Sc. examination.

W. H. Mills.

John Spiller.

A. G. Dix.

F. P. Dunn.

C. E. Sladden.

Hargreaves, Richard,
Chatburn, Clitheroe, Lancs.

Teacher. Science Graduate, Cambridge. Anxious to keep in touch with recent work in Chemistry.

Arthur J. Berry.	H. J. H. Fenton.
F. E. E. Lamplough.	J. G. M. Dunlop.
S. I. Levy.	F. H. Neville.

Hay, Alexander Houghton,
Essex Wharf, Narrow Street, Limehouse, E.

Chemist to Messrs. E. J. Hay & Co., Caramel Manufacturers, Limehouse, E. Educated at West Cliff College, Ramsgate, and at The City and Guilds Technical Institute under Professor Meldola.

R. Meldola.	B. H. Buttle.
A. J. Hale.	Arthur R. Ling.

Leonard Temple Thorne.

Hebden, George Alfred,
78, Norborough Road, Tinsley, Sheffield.

Analytical Chemist. Studied Chemistry at the Leeds Institute of Science for seven years. Ten years Assistant Chemist with Messrs. Brotherton & Co., Ltd., Leeds; at present Analytical Chemist with Messrs. Sheffield Chemical Co., Ltd., Rotherham.

Philip B. Nicholson.	Rowland H. Ellis.
James H. Kershaw.	R. W. Varley.

Francis R. Penn.

Hodges, Richard Pendarves,
42, Olive Road, Cricklewood.

Analytical Chemist. For three years articled to Leo Taylor, F.I.C., of 31, Moorgate Street, E.C., Public Analyst for the Boro' of Hackney. At present Assistant Chemist at Messrs. Johnson and Son, Paul Street, Finsbury, E.C.

B. C. Smith.	William Ping.
H. B. Maynard.	W. M. Seaber.

Percy Edgerton.

Hollely, William Francis,
67, Ross Road, Wallington, Surrey.

Research Assistant to Professor Meldola. Joint Author with the Professor of the following papers which have appeared in the "Transactions of the Chemical Society."—1912, Vol. 101: "Quinone-ammonium derivatives. Part I. The Methylation products of Picramic and Isopicramic acids." 1913, Vol. 103: "Part II. Nitro-haloid, Di-

haloid and Azo-compounds." An Associate of The Institute of Chemistry.

Raphael Meldola.

A. J. Hale.

B. H. Buttle.

L. Melville Clark.

Reginald F. Easton.

Huxtable, Charles,

"Devonia," Menlove Avenue, Liverpool.

Works Chemist and Analyst. Pharmaceutical Chemist with 20 years experience in Manufacturing and Analytical Chemistry. Desire to become a Member in order to keep in closer touch with Chemical Science and Progress.

W. A. H. Naylor.

H. Humphreys Jones.

John Taylor.

Thos. Tyrer.

Francis Ransom.

Hynd, Alexander,

196, Baldrigeburn, Dunfermline, N.B.

Research Chemist; Assistant to Professor Crowther, of the Agricultural Chemistry Department, University of Leeds. Since graduating M.A., B.Sc., in Oct., 1908, I, as Carnegie Scholar and Fellow, have been continuously engaged during the past five years in Chemical Research Work. The results of these investigations have been published in collaboration with Prof. Irvine in the "Transactions of the Chemical Society" and elsewhere. See Trans., 1909, 95, 1220; 1911, 99, 161 and 250; 1912, 101, 1128; 1913, 103, 41. Proc., 1912, 28, 54; and "Brit. Assoc. Reports," Dundee, 1912.

J. C. Irvine.

Thomas Purdie.

W. N. Haworth.

J. L. A. Macdonald.

William S. Denham.

Johnson, William,

"Walton," Stoneygate Avenue, Leicester.

Chemist to Messrs. Hawley & Johnson, Dyers, Leicester. Studied four years at Leeds University, specialising for two years in Colour Chemistry and Dyeing, and taking the B.Sc. degree in this subject with 1st Class Honours at end of third year. Leblanc medallist. Fourth year spent in research on Constitution of Aniline Black (work about to be published).

A. G. Green.

Arthur Smithells.

J. B. Cohen.

A. G. Perkin.

Henry R. Procter.

Jones, Harold Bramfield,

Broadway House, Northolme Road, Highbury, London, N.

Correspondence Tutor in Chemistry. Four years study in Chemistry

at London University (Internal Student); Candidate for B.Sc. (Hons. Chemistry) in October, 1913; 2 years as a corresponding Tutor in Chemistry.

W. H. Mills.

John Spiller.

H. Wingate.

C. R. Wilkins.

Alex. McKenzie.

Alex. C. Cumming.

Khan, Gholam Rasual,

Lyallpur, Punjab, India.

Student. (1) B.Sc. (Durham). (2) Barrister. (3) Wish to continue studies of Chemistry in connection with Indian Agriculture.

S. Hoare Collins.

J. A. Smythe.

P. Phillips Bedson.

F. C. Garrett.

Herbert Blair.

Leivesley, Sidney Oliver,

c/o W. Leivesley, Esq., Chillagoe, Nth. Queensland, Australia.

Analyst and Assayer. Assistant to Leo Taylor, F.I.C., Public Analyst for Hackney.

B. C. Smith.

W. M. Seaber.

Percy Edgerton.

E. G. Streimer.

F. H. Streetfeild.

Lewis, William John,

10, Lightoaks Road, Pendleton, Manchester.

Analytical Chemist. I received my training in Chemistry at the Royal Technical Institute, Salford, 1903-1907. I am at present Chief Assistant in the Central Laboratory of the British Cotton and Wool Dyers Assocn., Ltd.

C. Rawson.

J. R. Appleyard.

Ad. Liebmann.

B. Prentice.

E. Clark.

Lycett, Percival James,

Castle Hill, Wolverley, Kidderminster.

Works Chemist. Four years' training at Birmingham University in Chemistry, Bacteriology, and Metallurgy. Experience as Analytical Chemist in the General Laboratories of Messrs. Chance and Hunt's, of Oldbury, and later as Works and Analytical Chemist to the County Chemical Co. of Birmingham.

Arthur E. Crutchley.

H. J. Aubrey.

H. S. Shorthouse.

T. Vaughan Hughes.

Harry Silvester

Marchant, Frank Clifford,

St. Kilda's, Manor Road, Forest Hill, S.E.

Scientific and Technical Chemist and now reading for the qualification of A.I.C. About two and a-quarter years as student-assistant, and afterwards as assistant, in consulting and technical research laboratory. Wishes to extend his reading by the privilege of access to the Chemical Society's library; to be well in touch with current chemical literature; and to be able frequently to attend the meetings of the Society.

Charles E. Cassal.

A. H. M. Muter.

J. Kear Colwell.

Cecil H. Cribb.

Cyril Dickinson.

P. A. Ellis Richards.

Naik, Kunerji Gosai,

Berhampore, Dist. Murshidabad, Bengal, India.

Senior Professor of Chemistry, Krishnath College, Berhampore, Dist. Murshidabad, Bengal, India. M.A., B.Sc. (Bombay University). Senior Prof. of Chemistry in one of the First Grade Colleges of the Calcutta University; one of the Board of Examiners at the Inter. Arts and Science Exam. in Chemistry of the Calcutta University.

T. K. Gajjar.

M. J. Gajjar.

A. R. Normand.

Kapibram H. Vakil.

G. R. Rele.

Nichols, John Allen,

Stanley Mount, New Mills, Stockport.

Head Master, New Mills County Secondary School. Twenty-five years teacher of Chemistry at the New Mills Science and Technical School, and lecturer on the Chemistry of Bleaching, Dyeing and the products of coal tar. At present teaches Chemistry in the Secondary School and is Organising Master under the County Council of the Evening Classes in Chemistry and Technology for the district.

S. Bradbury.

Norman Smith.

Fred. R. Grundey.

E. C. Edgar.

Fred S. Watson.

Ch. Weizmann.

Thomas B. Hallowell.

A. Lapworth

Harold B. Dixon.

W. Gordon Carey.

Pattison, John Thomas,

72, Bath Road, Southsea, Hants.

Analyst. Student at Rutherford College, Newcastle-on-Tyne. Chief Analyst to the Aluminium Corporation, Ltd., Wallsend-on-Tyne. At

present Assistant Analyst, Admiralty Chemist's Department, H.M. Dockyard, Portsmouth.

Arnold Philip.

F. W. F. Arnaud.

Frank Wade.

M. O. Forster.

James C. Philip.

Powell, Wilfrid Roberts,

14, Marlborough Road, Richmond, Surrey.

Student. B.A. (London). Chemistry taken in Matriculation, Intermediate, and Final, at King's College, London. Assistant Analyst to The British Drug Houses, Limited, for $3\frac{1}{2}$ years.

Charles Alex. Hill.

Henry L. Smith.

J. Adam Watson.

Herbert Jackson.

W. L. Howie.

James D. Kettle.

Geo. Bult Francis.

W. A. H. Naylor.

Patrick H. Kirkaldy.

John M. Thomson.

Pracy, Henry Edward Findlater,

25, Grosvenor Park, Camberwell, S.E.

Scholar of Christ's College, Cambridge. I am going up to Cambridge for a course of Natural Science in October, and while I am there I intend to specialise in Chemical Research, and for this reason I desire to become a Fellow of the Society.

Chas. E. Browne.

Henry E. Armstrong.

E. W. L. Foxell.

C. S. Mummery.

J. Vargas Eyre.

Rolfe, Benedict Hugh, M.A.(Oxon.),

Wheatley, near Oxford.

Consulting Engineer Chemist. Education: Magdalen College School and Merton College, Oxon. M.A. Oxon. Originally in Medical School, Oxford University, but left in 1896 to undertake study and research in Industrial Chemistry and Physics. In professional practice as Consulting Engineer Chemist since 1900, principally in connection with Uranium, Vanadium, and treatment of Radioactive Minerals.

John S. MacArthur.

James F. Readman.

Allan F. Walden.

W. W. Fisher.

John Watts.

Stott, Philip Howard,

Tottington Road, Harwood, Bolton, Lancs.

Analytical Chemist. Works Chemist, Messrs. Jno. Summors and Sons, Stalybridge, Cheshire. Associate of the Manchester Municipal School of Technology. Holding the Certificate of the

Victoria University of Manchester in Technical Science and Chemical Technology.

E. Knecht.

E. L. Rhead.

H. F. Coward.

F. S. Sinnatt.

Sr J. Peachey.

Stuart, John McArthur,
Balliol College, Oxford.

Student of Chemistry. Studied chemistry for two years at Edinburgh University, and for two years at Oxford.

D. H. Nagel.

H. B. Hartley.

T. S. Moore.

M. P. Applebey.

N. V. Sidgwick.

Sutcliffe, John Algernon Lacy,
44, Broad Street, Birmingham.

Analytical Chemist. Associate of the Institute of Chemistry. Assistant Analyst to the City of Birmingham. Studied at the University of Leeds. Formerly Assistant to Dr. Harry Ingle, D.Sc., &c.

Arthur Smithells.

W. Lowson.

J. B. Cohen.

W. H. Perkins.

G. D. Elsdon.

Tayler, Harold Frank,
105, Barrow Road, Streatham, London, S.W.

Schoolmaster. Matriculated 1909. Studied Chemistry and Allied Sciences at University College, London, 1908-1910, and at King's College, London, 1910-12. Anxious to keep myself acquainted with current chemical research

John M. Thomson.

William Ramsay.

Patrick H. Kirkaldy.

F. Ion Richardson.

Howard V. Potter.

Tennant, Robert,
4, Park Terrace, Queen's Park, Glasgow.

Chemical Engineer and Analytical Chemist. Studied Chemistry at Royal Technical College, Glasgow. For 2½ years assistant to Douglas A. MacCallum, Esq., Analytical and Consulting Chemist, Glasgow. Assistant Chemist with Nobel's Explosives Co., Ardeer, for about 1 year. Manager of the Producer Gas Department of Messrs. Brand's Pure Spelter Co., Irvine, and supervised much experimental work in this capacity. Member Society of Chemical Industry.

Douglas A. MacCallum.

F. J. Wilson.

J. C. Butterfield.

F. W. Harris.

William Fowler.

A. D. Gardiner.

Walker, Henry,

10, Melrose Terrace, West Kensington Park, W.

Mechanical Engineer; Specialist in Cement Making Machinery; Fertiliser and Sulphuric Acid Plants. Designer of Installations for the Manufacture of Superphosphate Manures, and Specialist in the manufacture of Sulphuric Acid on the latest Continental systems.

H. E. Macadam.

J. Bruce Miller.

Robert Stephenson, jun.

Herbert R. Neech.

John S. Rigby.

Wood, Henry,

The Limes, 62, Culverden Road, Balham, S.W.

Studied Chemistry at Birkbeck College under Dr. J. E. Mackenzie and Dr. Alex. McKenzie, and now engaged in research.

Alex. McKenzie.

G. W. Clough.

Fred Barrow.

Geoffrey Martin.

Gerald H. Martin.

The following Certificate has been authorised by the Council for presentation to ballot under Bye-law I. (3):

Welch, Bertie Mandel,

Sydney.

Analyst and Assayer. Learned Chemistry in Alexander Orr's laboratory and Sydney Technical College, and passed S.T.C. Exams. Was Chief Chemist to the Lloyd Copper Co., N.S. Wales for five years, and Chemist with the Sulphide Corporation for three years. Experimented and reported on Oil Separation Process of Lloyd Copper Ores. Am Member of Society of Chemical Industry, and for six years have been partner of Alexander Orr as Public Analyst.

Alexander Orr.

Francis L. Watt.

Andrew J. Dixon.

T. U. Walton.

INTERNATIONAL ASSOCIATION OF CHEMICAL SOCIETIES

EXTRACT FROM THE MINUTES OF THE THIRD SESSION OF THE COUNCIL HELD IN THE INSTITUT SOLVAY (PHYSIOLOGIE), PARC LÉOPOLD, BRUSSELS *September 19th-23rd, 1913*

The following is a complete list of the members of the Council of the International Association of Chemical Societies arranged in alphabetical order of the names, in the French language, of the countries they represent.

Deutsche Chemische Gesellschaft.

- P. JACOBSON, Sigismundstrasse 4, Berlin W., 10.
W. OSTWALD, Gross-Bothen, Kgr., Sachsen.
O. N. WITT, Ebereschentallee 10, Westend, Berlin.

The Chemical Society (London).

- A. W. CROSSLEY, 10, Crediton Road, West Hampstead, London, N.W.
P. F. FRANKLAND, The University, Edgbaston, Birmingham.
WILLIAM RAMSAY, 19, Chester Terrace, Regent's Park, London, N.W.

Verein Oesterreichischer Chemiker.

- G. GOLDSCHMIEDT, Währingerstr. 10, Wien IX.
L. MARCHLEWSKI, Die Universität, Krakau.
R. WEGSCHEIDER, Währingerstr. 10, Wien IX.

Société Chimique de Belgique.

- L. CRISMER, l'École Militaire, Rue Hobéma, Bruxelles.
 H. VAN LAER, 83, Rue Berckmans, Bruxelles.
 J. WAUTERS, 83, Rue Souveraine, Bruxelles.

Kemisk Forening, Kjöbenhavn.

- E. BIILMANN, Ostervoldgade 5, Kjöbenhavn.
 N. BJERRUM, Ostervoldgade 5, Kjöbenhavn.
 J. PETERSEN, Sölvgade 83, Kjöbenhavn.

Sociedad Española di Física y Química.

- J. CASARES, GIL, l'Université de Madrid, Madrid.
 E. HAUSER, École des Mines, Madrid.
 J. R. MOURELO, Calle del Piamonte 14, Madrid.

American Chemical Society.

- H. R. MOODY, 330, Convent Avenue, New York City, U.S.A.
 W. A. NOYES, The University, Urbana, Ill., U.S.A.
 J. D. PENNOCK, Solvay Process Co., Syracuse, N.Y., U.S.A.

Société Chimique de France.

- A. BÉHAL, 4, Avenue de l'Observatoire, Paris.
 A. HALLER, 10, Rue Vauquelin, Paris.
 M. HANRIOT, 11, Quai Conti, Paris.

Nederlandsche Chemische Vereeniging.

- E. J. COHEN, Van't Hoff Laboratorium, Utrecht.
 A. F. HOLLEMAN, Oosterpark 59, Amsterdam.
 S. HOOGWERFF, Kleinhuize, Wassenaar.

Società Chimica Italiana.

- A. MENOZZI, R. Scuola Superiore di Agraria, Via Marsala 8, Milano.
 A. OGLIALORO, Istituto Chimico, Università, Napoli.
 E. PATERNÒ, Via Panisperna, 89 B, Roma.

Tokyo Chemical Society.

N. NAGAI, Imperial University, Tokyo.

J. SAKURAI, Imperial University, Tokyo.

T. TAKAMATSU, Imperial University, Tokyo.

Polyteknisk Forenings Kemikergruppe, Kristiania.

A. AUBERT, Dynamitfabrik, Engene, Sätre.

H. GOLDSCHMIDT, Drammensveien 82, Kristiania.

C. N. RIIBER, Technische Hochschule, Trondhjem.

Russian Chemical Society.

N. S. KURNAKOW, Berg-Institut, St. Petersburg.

L. A. TSCHUGAEFF, The University, St. Petersburg.

P. J. WALDEN, The Polytechnie, Riga.

Schweizerische Chemische Gesellschaft.

F. FICHTER, Neubadstr. 35, Basel.

P. A. GUYE, 3, Chemin Bizot, Florissant. Gent.

A. WERNER, Freiestr. 111, Zürich V.

All members of Council, excepting the delegates from the "Verein Oesterreichischer Chemiker," the "American Chemical Society," the "Tokyo Chemical Society," and the "Polyteknisk Forenings Kemikergruppe, Kristiania," were present at the meetings in Brussels.

There were also present, in an advisory capacity only, C. Marie (Société de Chimie-Physique), F. Auerbach (Deutsche Bunsen Gesellschaft), T. M. Lowry (The Faraday Society).

The Officers were: Sir William Ramsay, *President*; Percy Faraday Frankland, *Vice-President*; Arthur William Crossley, *General Secretary*.

The President occupied the Chair at all the meetings of the Council.

Since the last meetings of the Council held in Berlin, in April, 1912 the Société Chimique de Belgique has joined the Association, the total membership of which may be seen from the following list:—

	Date of entry.	Number of Members.
Deutsche Chemische Gesellschaft . . .	April 25th, 1911.	3,356
The Chemical Society (London) . . .	April 25th, 1911.	3,202
Verein Österreichischer Chemiker . . .	October 28th, 1911.	1,050
Société Chimique de Belgique	August 6th, 1913.	510
Kemisk Forening, Kjöbenhavn	January 23rd, 1912.	155
Sociedad Española di Física y Quimica	April 10th, 1912.	353
American Chemical Society	October 6th, 1911.	6,091
Société Chimique de France	April 25th, 1911.	1,023
Nederlandsche Chemische Vereeniging	July 14th, 1911.	515
Società Chimica Italiana	January 11th, 1912.	654
Tokyo Chemical Society	March 18th, 1912.	567
Polyteknisk Forenings Kemikerguppe, Kristiania	October 27th, 1911.	125
Russian Chemical Society	October 22nd, 1911.	410
Schweizerische Chemische Gesellschaft.	August 3rd, 1911.	367

The following Societies, not represented on the Council, each sent one delegate in an advisory capacity only to the meetings in Brussels, September, 1913.

Deutsche Bunsen Gesellschaft für An- gewandte Physikalische Chemie . . .	June 19th, 1911.	777
The Faraday Society (London) . . .	April 30th, 1912.	202
Société de Chimie Physique	June 15th, 1911.	225

19,582

In response to an invitation from the President, Professor Haller gave an account of the negotiations which had taken place between Monsieur Ernest Solvay and certain representatives of the International Association and which had resulted in the offer by Monsieur Solvay to make an unconditional gift of 250,000 francs to the Association. Further, Monsieur Solvay proposed to found an "International Institute of Chemistry," which shall have for its object the facilitation of the study and progress of chemistry, without, however, excluding problems belonging to other branches of the natural sciences, provided these have some bearing on the science of chemistry. The Institute will be governed by an "Administrative Commission" of three Belgian members (one nominated by His Majesty the King of the Belgians, a

second by the University of Brussels, and a third by Monsieur Ernest Solvay) and by a Delegation of the Council of the International Association of Chemical Societies, consisting of Messrs. Haller, Ostwald and Ramsay.

The Institute will have an annual income of 55,000 to 56,000 francs, the interest on 1,000,000 francs, which is to be distributed in such a manner that, for the next twenty-eight years, two-thirds of this sum (37,500 francs) will be placed at the disposal of the International Association of Chemical Societies, whilst the remaining third will be employed in establishing scholarships for Belgian students.

The Council gratefully accepted Monsieur Solvay's offers and proceeded to consider the Statutes of the "Institut International de Chimie Solvay," which with some slight alterations were adopted.

The Council gladly acceded to Monsieur Solvay's wish that he should be allowed to nominate two persons to attend all lectures given in the "Institut International de Chimie" and further passed the following resolution:—

"Ces sessions se tiendront autant que possible une fois sur deux à Bruxelles."

Monsieur Solvay has also provided the International Association with Offices in Brussels, where the archives will be kept and a permanent Secretary is to be appointed to take charge of them, and to conduct the general business of the Association.

The Council then considered the Statutes of the International Association, in which some alterations were necessitated by the acceptance of Monsieur Solvay's gifts; for as the Association has thereby become possessed of funds, certain provisions of Belgian law must be complied with, and the Statutes have therefore been referred to a small Committee for revision and will be finally considered at the next meeting of the Council.

The Members of the Delegation of the Council of the Association on the Governing Body of the "Institut International de Chimie Solvay" (Messrs. Haller, Ostwald and Ramsay) together with Messrs. Guye, Paternò, Van Laer and Walden were appointed a Commission to report at the next Session of the Council on the employment of the financial resources of the Association; and further to advise the

Bureau (*a*) on the investment of the funds belonging to the Association, (*b*) on the use of the interest arising therefrom, (*c*) on the use of the income of the "Institut International de Chimie Solvay."

Professor Haller was elected President of the Association for the ensuing year, and it was decided that the next meetings should be held in Paris, sometime during the first fifteen days of September, 1914. The Officers of the Association at the present time are therefore:—

President.—Albin Haller, 10, rue Vauquelin, Paris.

Vice-President.—M. Hanriot, 11, Quai Conti, Paris.

General Secretary.—A. Béhal, 4, Avenue de l'Observatoire, Paris.

and all communications should be addressed to Professor A. Béhal.

Statutes for the affiliation of the "International Committee on Atomic Weights" were next discussed and with certain alterations they were accepted by the Council, provided the International Committee on Atomic Weights is willing to adopt the suggested alterations.

Professor Guye presented a report on the "Unification of abbreviations of titles for Scientific Journals used in Chemical Memoirs," and gave an explanation of its aims and objects. As a result of the discussion which followed, the Council decided to communicate with the editors of all periodicals publishing chemical memoirs. If it appears that a sufficient majority is of opinion that great convenience would follow from a unification of abbreviations of titles for Scientific Journals, the Council of the International Association will then communicate with the Council of the International Catalogue of Scientific Literature and ask them to arrange the conditions necessary for publishing a separate list of the abbreviations used by the International Catalogue for periodicals publishing chemical memoirs. The Council will request that this list be submitted, in the first place, to a small Commission (composed of certain persons nominated by the Council of the International Association), which shall satisfy itself that the list is complete and propose simplifications compatible with the rules adopted by the International Catalogue.

As soon as an agreement is arrived at, the list will be circulated among the Societies affiliated to the Association, together with an invitation definitely to adopt the abbreviations for all future publications.

Professor Werner read and explained the Report of the Commission appointed to consider the question of "the mitigation of the difficulties arising from the existing multiplicity of languages employed in scientific literature," and pointed to the possibility of the formation of an International Journal of Abstracts in three languages, in which all publications of a chemical nature would be dealt with.

After prolonged discussion the Commission was reappointed to report to the next meeting of the Council, more particularly on three points:—

(a) the publication of an International Journal of Abstracts in three languages ;

(b) the publication of three editions of an International Journal of Abstracts, namely, in English, French and German.

(c) the publication of an International Journal, containing translations into either English, French or German of original papers appearing in the lesser known languages.

The question of co-operation in the publication of Abstracts, as raised in a letter from Professor W. A. Noyes, was also referred to this Commission for consideration and report.

A statement was read relative to the answers received to the letters sent to members of Council with regard to:—

(a) the adoption of Weltformat (16×22.6 cm.) for all publications.

(b) the universal adoption of the metric system for terms expressing weight and mass.

(c) Suggestions as to new terms of nomenclature.

The replies received were unanimously unfavourable to the adoption

of Weltformat; in favour of the use of the metric system, and generally in agreement with the views of the Council that the introduction of new suggestions for nomenclature in place of existing terms should be avoided as far as possible until the question of nomenclature has been formulated by the Association. This is not meant to prejudice the publication of new suggestions when the necessity arises in consequence, for example, of the discovery of new types of compounds. Authors' suggestions regarding nomenclature should be submitted to the existing committees for their consideration.

The Council received and adopted the following Report from the Commission for the Unification of Physico-Chemical Symbols.

A meeting of the International Commission for the Unification of Physico-Chemical Symbols was held in the Institut Solvay, Brussels, on Monday, September 22nd, 1913, when the following list of symbols was drawn up and recommended for provisional adoption by the Council till its next meeting in 1914.

In drawing up the list of symbols, the Commission decided to adopt *as far as possible*, as a basis of notation, the following two principles, namely:

1. Each symbol shall have only one definite signification.
2. Where it appears impossible to avoid using the same letter for different quantities, the symbols shall be distinguished by a letter, added as subscript.

This second principle was also adopted in the case of individual members of a group, *e.g.*, volume, specific volume, molecular volume, critical volume, &c. The Commission, however, recognised that there are practical difficulties in the way of a strict adherence to these principles. Although, therefore, in the list of symbols recommended by the Commission, a given symbol may have more than one signification, the Commission have also suggested alternative symbols which may be used in those cases where confusion may arise. Thus, for example, the Commission recommends that *R* should be used as the symbol both for the gas constant and for electrical resistance; but that in those cases

where there is a possibility of confusion, the alternative symbol R_W may be employed for the latter quantity. The addition of the letter W here recalls the use of this letter for electrical resistance frequently met with in Germany.

In making these suggestions, the Commission took into consideration the symbols proposed by the National Committees of the American, French and London Chemical Societies, as well as by the Bunsen Gesellschaft, the Ausschuss für Einheiten und Formelzeichen, and the International Electro-technical Commission. A large measure of agreement already existed between the proposals of these different bodies, but in those cases where there was disagreement, the reasons for the adoption by the Commission of the symbols recommended are stated in the column headed "Remarks."

The Commission decided to recommend the employment of only Greek and Roman characters, and, in the case of the latter, that the letters should be printed in the *italicised (sloping) form*. The Commission was of opinion that small Roman capitals should not be employed on account of the difficulty of distinguishing them from the ordinary letters.

Name of Quantity.	Symbols Recommended.		Remarks.
	Usual Symbol.	Alternative Symbol to be used in cases where confusion with other symbols may arise.	

1. General Physics and Mathematics.

Acceleration due to gravity...	g		The symbols α , F , and s have been variously suggested. The Commission recommends q (quadrate, Quadrat), as a suitable international symbol.
Ångström unit (10^{-10} metre).	\AA		
Area	q		

Name of Quantity.	Symbols Recommended.		Remarks.
	Usual Symbol.	Alternative Symbol.	
1. General Physics and Mathematics—contd.			
Base of natural logarithms ...	e		
Co-ordinates, variables ...	x, y, z		
Critical quantities : pressure, volume, temperature (Centigrade), temperature (absolute), density	$p_c \quad v_c$ $t_c \quad T_c$ d_c		Recommended in place of Greek letters, in accordance with the general principles adopted by the Commission.
Density (mass per unit volume)	d	D	D may be used, for example, in the differential $\frac{dD}{dt}$.
Diameter	d		Suggested ; not definitely recommended.
Differential sign, total ...	d		
Differential sign, partial ...	∂		
Fluidity	ϕ		Suggested ; not definitely recommended.
Force	f		
Gas constant per mole ...	R		
Height	h		Suggested ; not definitely recommended.
Increment	Δ		
Length	l		
Mass	m		
Mean free path	λ	λ_f	λ_f may be used in order to distinguish from λ =wave-length of light.
Micron (10^{-6} metre)... ..	μ		
Millimicron (10^{-9} metre) ...	$\mu\mu$		The Commission recognises that the symbol $\mu\mu$ ($=\mu \times 10^{-3}$) is not strictly logical, but recommends that owing to the universality of its use it should be retained.
Number (of terms, revolutions, &c.); number of molecules	n		
Number of moles	N		

Name of Quantity.	Symbols Recommended.		Remarks.
	Usual Symbol.	Alternative Symbol.	
1. <i>General Physics and Mathematics</i> —contd.			
Pressure	p		The use of γ is recommended as chief symbol on account of its employment in the classical researches dealing with this subject.
Pressure, osmotic	P		
Radius	r		
Ratio of circumference to diameter	π		
Reduced quantities : pressure, volume, temperature, density	$\left. \begin{array}{l} p_r \ v_r \\ T_r \ d_r \end{array} \right\}$		
Summation sign		Σ	
Surface tension	γ	σ	
Time	t		
van der Waals' constants ...	a, b		
Variation sign	δ		
Velocity	u		
Velocity, angular	ω		
Velocity components in three directions	u, v, w		
Viscosity	η		This symbol is recommended as being in accordance with the usage among physicists.
Volume (in general)	v		
Volume, specific	v_s		
Volume, atomic	v_a		
Volume, molecular	v_m		
Weight, as gravitational force	w		
Work	W^*		

* The letter A has been adopted as the symbol for "Work" by the Ausschuss für Einheiten und Formelzeichen and by the International Electrotechnical Commission. The latter body has adopted W as an alternative symbol.

Name of Quantity.	Symbols Recommended.		Remarks
	Usual Symbol.	Alternative Symbol.	

2. General Chemistry.

Atomic weight, and gram-atomic weight	A	
Concentration (units not specified)	c	
Equilibrium constant ...	K	
Mole fraction ...	x	
Molecular and gram-molecular weight	M	
van't Hoff coefficient ...	i	
Velocity coefficient ...	k	

3. Heat and Thermodynamics.

Energy, in general ...	E	Suggested; not definitely recommended.
Entropy ...	Φ	This symbol, used by Willard Gibbs and others, is recommended, since S is adopted for molecular heat.
Intrinsic energy ...	U	
Latent heat, per gram ...	l	
Latent heat, per mole ...	L	
Mechanical equivalent of heat	J	
Molecular heat ...	S	
Molecular heat at constant pressure	S_p	
Molecular heat at constant volume	S_v	
Quantity of heat ...	Q	
Ratio of specific heats ($= S_p/S_v$)	γ	This symbol is recommended in preference to κ as being in growing use amongst physicists.

Name of Quantity.	Symbols Recommended.		Remarks.
	Usual Symbol.	Alternative Symbol.	

3. *Heat and Thermodynamics*—contd.

Specific heat	s		The symbol s is recommended in place of c as being in growing use among physicists, and to avoid confusion with "concentration"
Specific heat at constant pressure	s_p		
Specific heat at constant volume	s_v		
Temperature, Centigrade ...	t or t°	θ	θ may be used when "temperature" and "time" occur in the same expression.
Temperature, absolute ...	T		

4. *Optics*.

Intensity of illumination ...	I	I_L	Recommended as finding most general approval.
Refractive index	n	n_r	
Refractive power, specific (Gladstone and Dale)	r_a $[r_a]_D^c$		The second symbol is used when it is desired to indicate the temperature and wave-length of light.
Refractive power, specific (Lorentz and Lorenz)	r_L $[r_L]_D^c$		
Refractive power, molecular	R_a $[R_a]_D^c$ R_L $[R_L]_D^c$		Suggested ; not definitely recommended.
Rotation, angle of optical ...	α		
Rotatory power, specific ...	$[\alpha]$		
Rotatory power, molecular ...	$M[\alpha]$		
Velocity of light	v		Suggested ; not definitely recommended.
Wave-length of light ...	λ		

Name of Quantity.	Symbols Recommended.		Remarks.
	Usual Symbol.	Alternative Symbol.	
5. Electricity and Magnetism.			
Capacity (electric)	C		
Charge, unitary (charge on an electron)	e		
Conductivity (specific conductance)	κ		
Conductivity equivalent ...	Λ		$\Lambda = \frac{1000 \kappa}{\text{concentration in gram-equivalents per litre.}}$
Conductivity equivalent (at different dilutions—volumes in litres containing 1 gram equivalent)	Λ_{10} Λ_v Λ_∞		
Conductivity, equivalent, of cation and anion	Λ_c Λ_a		
Conductivity, equivalent, of specified ions	Λ_K Λ_{Cl}		
Current	I		
Dielectric constant	K		As an <i>abbreviation</i> , the symbol <i>D.C.</i> is recommended.
Dissociation, electrolytic, degree of (degree of ionisation)	α		This is recommended in preference to γ on account of the adoption of the latter symbol for surface tension and ratio of specific heats.
Electro-motive force... ..	E		
Faraday's constant	F		
Permeability, magnetic ...	μ	μ_p	
Potential, single electrode, or decomposition potential of an ion	ϵ		The symbol ϵ is recommended in place of E as the latter is adopted as the symbol for electro-motive force.
Potential measured against the hydrogen or calomel electrode respectively, which is taken as unity	ϵ_h ϵ		

Name of Quantity.	Symbols Recommended.		Remarks.
	Usual Symbol.	Alternative Symbol.	
5. <i>Electricity and Magnetism</i> —contd.			
Quantity of electricity ...	Q		The symbol R has been adopted by the International Electrotechnical Commission.
Resistance	R	R_w	
Susceptibility, magnetic ...	κ		
Transport number of cation and of anion	n_c n_A		
Velocity of cation and of anion in cm./sec. when the potential gradient is 1 volt/cm.	U_c U_A		
Velocity of specified ions under unit potential gradient	U_K . U_{Cl}		

The Commission reserved consideration of symbols for the following quantities: Coefficient of self-induction; Concentration, expressed in various units; Current density; Diffusion coefficients; Free energy; Mobility of ions; Solubility; Critical solution temperature.

The Council received the following Report from the Inorganic Nomenclature Committee, and adopted the recommendations contained therein.

“After consideration of the reports of the National Committees, this Committee is unanimously in favour of adopting the symbols:

I for Iodine
 Xe „ Xenon.
 W „ Wolfram.
 Nb „ Niobium.

but is of opinion that the question of adopting the symbol Be for Beryllium, in place of Gl, should be referred to the prospective Inter-

national Commission on Inorganic Nomenclature, with a strong recommendation in favour of the symbol Be.

The Committee recommends that in indexing inorganic compounds the constituent atoms, including carbon, should be arranged in alphabetical order.

It is not desirable to place carbon at the commencement of the formula as is usual in indexing organic compounds. It is, however, desirable to make an exception to the alphabetical order in the cases of hydrogen and oxygen, which should always be placed at the end of the formula.

In order to facilitate reference to compounds containing water of crystallisation, it is suggested that it would be desirable to insert, after the formula of the anhydrous compound, the formulæ of the hydrated varieties, both in the form $F + xH_2O$, and in the empirical form with the hydrogen and oxygen embodied therein.

Binary compounds are to be regarded as additive and not as substitution compounds, the negative component forming the termination, and indicating the class of compound, and the positive component providing the name of the individual.

The recommendations of the Austrian and Russian National Committees for indicating the relative numbers of atoms of each element in the molecule are approved; e.g. N_2O_5 becomes dinitrogen pentoxide and not nitrogen pentoxide.

In order to obtain shorter names for substances, it is considered desirable to indicate the valency of the positive component by means of a suffix, the valencies one to eight being represented by the suffixes o, a, i, e, -on, -an, -in, -en, in the order given, e.g., the two chlorides of mercury would be respectively named mercurio and mercura chloride.

It is recommended that an International Commission, composed of one member from each country represented in the Association, be appointed, with Professor Werner as Chairman, by November 1st, 1913, at latest.

This International Commission should appoint a small working Committee of seven members, whose expenses should be defrayed out of the funds of the International Association of Chemical Societies."

The Report of the Organic Nomenclature Committee did not deal with details of nomenclature. It contained the following recommendations to the Council:—

(a) To appoint an International Commission on Organic Nomenclature consisting of one delegate from each country represented in the Association; this Commission to appoint a small working Committee of five members, not necessarily members of Council, to receive and consider the reports of the National Committees, and further to suggest methods for the organisation and carrying out of future work.

(b) To defray the expenses of this small Committee out of the funds of the Association.

After discussion of the suggestions contained in the above report, the Council resolved:—

1. That International Commissions on Inorganic and Organic Nomenclature, also for the Unification of Physico-Chemical Symbols, be appointed, consisting of one delegate from each country represented in the Association. These Commissions shall appoint small working Committees of five members (in the case of the Inorganic Nomenclature Commission, seven members), not necessarily members of Council, to receive and consider the reports of the National Committees, and further to suggest methods for the organisation and carrying out of future work.
2. That the expenses of these small Committees, including personal expenses of members, shall be defrayed out of the funds of the Association.

The following were then nominated to serve as members of the three International Commissions mentioned in Resolution 1:—

Inorganic Nomenclature Commission.	Organic Nomenclature Commission.	Unification of Physico- Chemical Symbols Commission.
W. Ostwald.	O. N. Witt.	W. Ostwald.
W. Ramsay.	P. F. Frankland	W. Ramsay (<i>Chair-</i>
R. Wegscheider.	(<i>Chairman</i>).	<i>man</i>).
L. Crismer.	G. Goldschmiedt.	R. Wegscheider.

Inorganic Nomenclature Commission.	Organic Nomenclature Commission.	Unification of Physico- Chemical Symbols Commission.
J. Petersen.	H. Van Laer.	L. Crismer.
J. Casares.	E. Biilmann.	N. Bjerrum.
H. R. Moody.	J. R. Mourelo.	E. Hauser.
M. Hanriot.	W. A. Noyes.	J. D. Pennock.
S. Hoogewerff.	A. Béhal.	M. Hanriot.
A. Menozzi.	A. F. Holleman.	E. J. Cohen.
T. Takamatsu.	E. Paternò.	E. Paternò.
H. Goldschmidt.	J. Sakurai.	N. Nagai.
N. S. Kurnakow.	C. N. Riiber.	H. Goldschmidt.
A. Werner (<i>Chair- man</i>).	L. A. Tschugaeff.	P. J. Walden.
	F. Fichter.	P. A. Guye.

It was also resolved in accordance with a resolution proposed by Professor Cohen that :—

The Council of the International Association of Chemical Societies, having considered the propositions for co-operation formulated by the International Committee of "Tables Annuelles de Constantes et Données Numériques de Chimie, de Physique et de Technologie," appoints a Commission, consisting of Messrs. Guye, Ostwald and Ramsay to determine, after consultation with the members of the Permanent Commission of the International Committee, how this co-operation can be realised and to present a report on this question at the next meetings of the Council of the International Association of Chemical Societies.

A statement of accounts was presented and approved by the Council. Since, however, the Association is now possessed of funds affiliated Societies will no longer be invited to pay any share of the expenses of the Association.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29

No. 421.

Thursday, December 4th, 1913, at 8.30 p.m., Prof. W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society through the death of:

	<i>Elected.</i>	<i>Died.</i>
James Tudor Cundall (Edinburgh)	March 17th, 1887.	July 24th, 1913.
Thomas Ebenezer Pye (Chichester)	July 5th, 1906.	Oct. 15th, 1913.

The PRESIDENT announced that the Society had replenished its stock of apparatus and reagents for the use of Fellows making experiments at the meetings of the Society. Fellows can obtain a list of the apparatus and reagents by applying to the Assistant Secretary.

Certificates were read for the first time in favour of Messrs.:

Sydney George Clifford, 3 Norman Villas, East Dulwich, S.E.

Thomas Alexander Davidson, 57, Strathyre Avenue, Norbury.

Thomas Eynon Davies, B.Sc., 25, Trevor Street, Aberdare.

James Stanley Hale, Principe 4, Bilbao, Spain.

Alfred John Leigh, B.Sc., Duff House, Banff.

Archibald Macpherson, 51, Keir Street, Glasgow.

Frederick Arthur Makin, The Nest, Taunton Road, Ashton-under-Lyne.

Thomas Morris, 53, Poolstock, Wigan.

Raymond William Nichols, Central Experimental Farm, Ottawa, Canada.

William Julian Odlum, B.A., Ardmore, Bray.

Charles Alfred Stamp, Passey's House, Eltham.

Eustace Ebenezer Turner, B.Sc., 5, Queen's Gate Villas, South Hackney, N.E.

Messrs. Harold King and W. B. Tuck were elected Scrutators, and a ballot for the election of Fellows was held. The following were subsequently declared as duly elected :

Parmanand Mewaram Advani, M.A.,
B.Sc.

Richard Watson Askew, B.A.

Sankar Rao B. Badami, M.A.

Alan Milsom Bailey.

Stanley Charles Bate, B.Sc.

Alan Hamilton Bateman.

Charles Maurice Berlein, B.A.

Arthur Bicknell, B.Sc.

Augustus Pearce Llewellyn Blaxter, B.A.

Adhor Krishna Bose.

Arthur Bramley, B.Sc.

Arthur Joseph Brearley, B.A.

George Bernard Butler.

Bertram Campbell, B.Sc.

Norman Phillips Campbell, B.A.

Frederick George Carter.

Santi Pada Chowdry.

Francis William Clark.

Herbert Stoddard Coleman.

Thomas James Drakeley, B.Sc.

Mohamed Shams Eldin, B.Sc.

Cyril Duncan Fuller.

Charles John Dickenson Gair.

Stanton Gibson, B.Sc.

Richard Hargreaves, B.A.

Alexander Houghton Hay.

George Alfred Hebden.

Richard Pendarves Hodges.

William Francis Hollely.

Charles Huxtable.

Alexander Hynd, M.A., B.Sc.

William Johnson, B.Sc.

Harold Bramfield Jones.

Ghulam Rasul Khan, B.Sc.

Sidney Oliver Leivesley.

William John Lewis.

Percival James Lyeett.

Frank Clifford Marchant.

Kunerji Gosai Naik, M.A., B.Sc.

John Allen Nichols.

John Thomas Pattison.

Wilfrid Roberts Powell, B.A.

Henry Edward Findlater Pracy.

Benedict Hugh Rolfe, M.A.

Philip Howard Stott.

John McArthur Stuart.

John Algernon Lacy Sutcliffe.

Harold Frank Tayler.

Robert Tennant.

Henry Walker.

Bertie Mandel Welch.

Henry Wood.

Of the following papers, those marked * were read :

***305. "The action of sulphuric acid on copper."**

By (the late) James Tudor Cundall.

It is commonly supposed that the mutual action of copper and sulphuric acid may be represented by the production first of cupric sulphate and nascent hydrogen, which latter produces more sulphuric acid and from it sulphur dioxide.

The present investigation shows that cuprous sulphate, rather than cupric sulphate, is one of the primary products, as may easily be tested by pouring off the sulphuric acid at any stage of the reaction through a Gooch filter into water, when a precipitate of

finely divided copper is produced. This result is best obtained when the sulphuric acid is slightly diluted with water, for when hot or concentrated acid is used, the cuprous sulphate acts on the acid almost as soon as formed, giving cuprous sulphide and cupric sulphate. This last action also takes place, but more slowly, with cooler acid.

The cuprous sulphide then, as Pickering found, becomes oxidised to cupric sulphide and cupric sulphate with evolution of sulphur dioxide, and thereafter the cupric sulphide gives the sulphate, with a further evolution of gas.

***306. "Synthesis of polypeptides from the higher fatty acids."**

By Arthur Hopwood.

Although so many polypeptides have been prepared lately, only one has been obtained from the higher fatty acids. The author has therefore synthesised several dipeptides from palmitic and stearic acids, so that their properties could be ascertained and compared with those of the degradation products of the proteins.

α -Bromopalmityl chloride, $C_{15}H_{30}Br \cdot COCl$, prepared from α -bromopalmitic acid and thionyl chloride, is a colourless oil, which crystallises on cooling, and boils with decomposition at about $215^{\circ}/20$ mm.

α -Bromopalmitylglycine, $C_{15}H_{30}Br \cdot CO \cdot NH \cdot CH_2 \cdot CO_2H$, prepared by condensing α -bromopalmityl chloride with glycine, crystallises in colourless plates, melting at $118-121^{\circ}$.

α -Aminopalmitylglycine, $NH_2 \cdot C_{15}H_{30} \cdot CO \cdot NH \cdot CH_2 \cdot CO_2H$, prepared by heating α -bromopalmitylglycine with ammonia, crystallises in colourless, hexagonal plates, melting and decomposing at $222-224^{\circ}$.

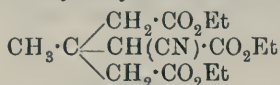
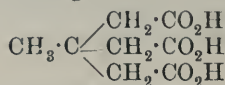
Similar dipeptides have been prepared by coupling α -bromopalmityl or α -bromostearyl chloride with alanine or leucine, and heating the products with ammonia. Isomerides of these dipeptides have also been prepared by the action of ammonia on the products obtained by condensing α -bromoacetyl, α -bromopropionyl, or α -bromo-isohexoyl chloride with α -aminopalmitic or α -aminostearic acid.

The dipeptides derived from palmitic and stearic acids are tasteless, or slightly bitter, crystalline solids melting and decomposing at above 200° . They are insoluble in water, alcohol, ether, or benzene, but dissolve in hot dilute mineral acids or alkali hydroxides. They form characteristic crystalline compounds with β -naphthalene-sulphonyl chloride, and, like the natural proteins, the dipeptides give white, amorphous precipitates with phosphotungstic acid.

*307. "A new series of ring compounds." (Preliminary note.)

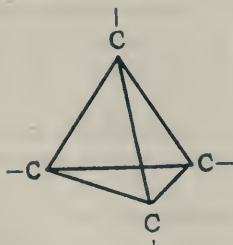
By Richard Moore Beesley and Jocelyn Field Thorpe.

The fact that the ethyl ester of labile β -methylglutaconic acid, which can be readily obtained from ethyl acetoacetate (T., 1912, 101, 1565), condenses with the sodium compound of ethyl cyanoacetate, yielding the cyano-ester (I), and that from this ester an almost quantitative yield of the tricarboxylic acid (II) can be obtained on hydrolysis, has led to an investigation in which the

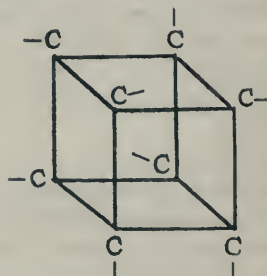
(I.) (M. p. 30° .)(II.) (M. p. 172° .)

possibility of the existence of "enclosed" or "caged" carbon rings has been studied.

It is evident that the simplest type of such a series would be the enclosed four-carbon ring, in which the carbon atoms occupy the four points of a tetrahedron, as in formula (III), whilst another type would be the "caged" cube, as in formula (IV):

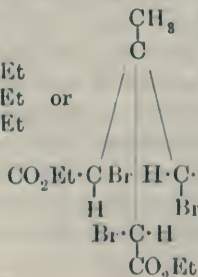
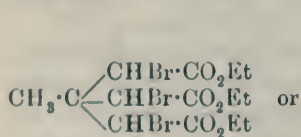


(III.)

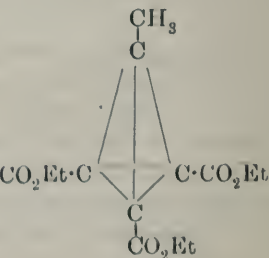


(IV.)

It is well known that the esters of the bromoglutaric acids eliminate hydrogen bromide and pass into derivatives of *cyclopropane*, and it therefore follows that if this reaction could be applied to the tribromo-ester (V), which can be prepared by the bromination of the acid (II), that ring-formation would ensue in accordance with the following scheme:



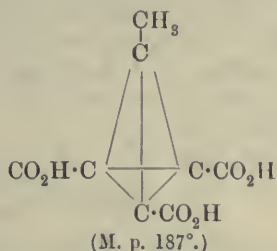
(V.)



(VI.)

Many difficulties were experienced in attempting to accomplish this change, because it was found that all the usual reagents, employed for the purpose of eliminating hydrogen bromide, led to the production of the corresponding lactones. Ultimately a reaction was discovered, which has since been found to succeed in a number of other cases, and seems to favour the formation of the carbon ring from compounds of this character. The reaction is carried out by adding the bromo-ester to a very concentrated aqueous solution of potassium hydroxide at 130° . The reaction is very violent, but the more violent it is the better is the yield of the ring compound.

By the aid of this reaction, the tribromo-ester (V) has been converted into a tricarboxylic acid having the formula $C_8H_6O_6$, which has all the properties of the "caged" ring tricarboxylic acid:

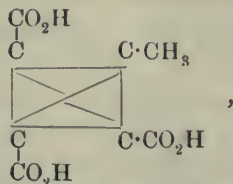


The acid is a remarkably stable substance, and does not decolorise alkaline permanganate in the cold; it is not attacked by bromine at the ordinary temperature. It yields methylsuccinic acid when oxidised by hot alkaline permanganate.

DISCUSSION.

In reply to Prof. Armstrong, Dr. THORPE said that so soon as larger quantities of material had been prepared it was his intention to study the action of hydrogen bromide, but it was necessary in order thoroughly to investigate the products of this reaction that considerable quantities of material should be available.

In reply to Sir W. Ramsay, he said that the formula of the "caged" ring compound could only be expressed in the plane of the paper by:

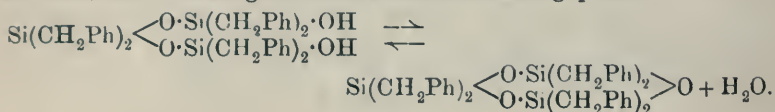


representing the compound as a derivative of *cyclobutane*, which it certainly was not.

- *308. "Organic derivatives of silicon. Part XX. Some condensation products of dibenzylsilicanediol." By Robert Robison and Frederic Stanley Kipping.

The two condensation products of dibenzylsilicanediol, namely, anhydrobisdibenzylsilicanediol and trianhydrotrisdibenzylsilicanediol (Robison and Kipping, T., 1912, **101**, 2142), have been further studied in order to ascertain the conditions under which they are formed.

A further condensation product, namely, *dianhydrotrisdibenzylsilicanediol*, $\text{HO}\cdot\text{Si}(\text{CH}_2\text{Ph})_2\cdot\text{O}\cdot\text{Si}(\text{CH}_2\text{Ph})_2\cdot\text{O}\cdot\text{Si}(\text{CH}_2\text{Ph})_2\cdot\text{OH}$, has also been obtained by the partial hydrolysis of trianhydrotrisdibenzylsilicanediol with potassium hydroxide, and with hydrochloric acid, in a suitable solvent. This compound crystallises in massive prisms, melting at 82° , and is analogous to dianhydrotrisdiphenylsilicanediol; it is readily transformed into trianhydrotrisdiphenylsilicanediol when it is treated with hydrogen chloride in alcoholic solution, the following reversible reaction taking place:



- *309. "The rotatory dispersive power of organic compounds. Part V. A comparison of the optical and magnetic rotatory dispersions in some optically active liquids." By Thomas Martin Lowry, Robert Howson Pickard, and Joseph Kenyon.

After examining thirty-four optically active liquids, only two cases have been found in which the optical and magnetic rotatory dispersions are approximately equal; even this equality is fortuitous, as it does not appear in the next homologues. Wiedemann's law, which applies exactly in the case of quartz, does not therefore hold good for optically active liquids.

310. "A relation between chemical constitution and depth of colour of dyes." By Edwin Roy Watson.

The theory is put forward that those dyes which are quinonoid in all possible tautomeric forms exhibit a deep colour, however simple the molecule may be. On the other hand, if there is the possibility of the molecule existing in a non-quinonoid form, it may not attain a deep colour, although the molecular complexity may be very considerable. A survey of all the better known dye-stuffs

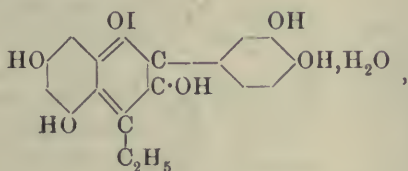
fully bears out this theory, and it explains remarkable differences in depths of colour between dyes of very similar constitution. A permanent quinonoid structure alone is not sufficient, for example, dihydroxy-*p*-benzoquinone; the substance must be capable of tautomerising from one quinonoid arrangement to another.

The theory has been fully borne out by the preparation of dyes of deep colour from quercetin

311. "Dyes derived from quercetin."

By Edwin Roy Watson and Kumud Behari Sen.

By the action of magnesium ethyl iodide on quercetin pentaethyl ether, there is obtained 3:5:7-*triethoxy-2-m-p-diethoxyphenyl-4-ethyl-1:4-benzopyran anhydrohydriodide*, which, on de-ethylation, yields 3:5:7-*trihydroxy-2-m-p-dihydroxyphenyl-4-ethyl-1:4-benzopyran anhydrohydriodide*:



this dyes wool violet (on alum and chrome) and crimson (on tin).

3:5-*Dihydroxy-7-keto-4-dimethylaminophenyl-2-m-p-dihydroxyphenyl-1:4-benzopyran*, obtained from quercetin by the action of dimethylaniline in the presence of phosphoryl chloride, dyes wool in slaty-blue shades on all mordants. 3:4:5:7-*Tetrahydroxy-2-m-p-dihydroxyphenyl-1:4-benzopyran*, prepared by the reduction of quercetin by sodium amalgam in alcoholic hydrochloric acid solution, dissolves in alcohol with a magenta colour, and in potassium hydroxide to a green solution, but is very readily oxidised to quercetin.

Several other derivatives of quercetin and 2-phenyl-1:4-benzopyran were also prepared.

312. "An improved apparatus for the determination of molecular weight by the Landsberger-Sakurai method." By William Ernest Stephen Turner and Cornelius Theodore Pollard.

The great convenience of the Landsberger-Sakurai method of determining molecular weights, especially as a time-saver,* has led

* Besides saving time, the rapidity of the process permits the investigation of substances which would decompose during the prolonged boiling involved in the ordinary Beckmann method. Such substances are triethylsulphonium salts (see

to its adoption in principle in a number of pieces of apparatus devised by subsequent investigators. Most of these forms, however, are unsuitable for accurate work, and in a paper which discussed the various sources of error in the Landsberger-Sakurai method (Turner, T., 1910, **97**, 1184) an apparatus was described which enabled rapid and accurate measurements to be undertaken.

During the course of some three years' work with this apparatus, several improvements have suggested themselves, and have been collected in the new form figured below.

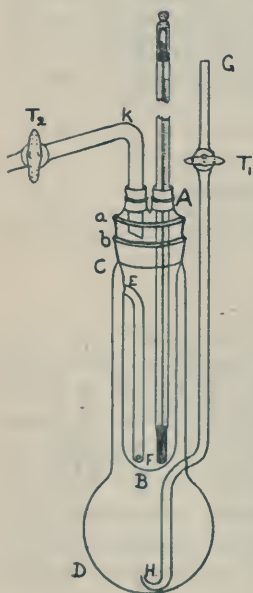
The most important alteration of the original is the use of the boiler as the constant temperature jacket.* For one of the disadvantages of the Landsberger and Sakurai forms of apparatus is that the molecular-weight tube fills so readily as to make it difficult, with easily condensable vapours, to obtain more than three or four readings in a series. By using the boiler as outer jacket and making the entrance for the vapour stream high up in the molecular-weight tube, the cooler solvent or solution in the tube is heated considerably before the entrance of vapour, and the amount of condensation thus diminished.

The molecular-weight tube *AB*, 17.5 cm. in length, 2.8 cm. diameter in the main portion, and 3.5 cm. at the mouth, carries a ground-glass stopper with two tubulures, fitting flush with the mouth of the tube at *a*. To the solvent or solution under measurement, vapour is admitted through two perforations at the bottom of the tube *EF*, the entrance *E* being 12 cm. from the lower end

of the molecular-weight tube. The outer jacket *CD*, of approximately 5 cm. diameter in the cylindrical portion, fits the molecular-weight tube at a second ground joint at *b*, and carries a safety-tube *GH*, provided with a tap *T*₁. Although shown in one piece, the tube sealed into the boiler reached only the level of the tubulated stopper, and the tap was connected by rubber tubing, the ends of the tubes being in contact. Whilst a determination is in progress, *T*₁ is usually closed in order to drive a steady stream of vapour through *E*, but when the molecular-weight tube has been removed

Turner, T., 1911, **99**, 880) and amylamine hydrochloride (Turner, *loc. cit.*; compare Hantzsch and Hofmann, *Ber.*, 1911, **44**, 1776).

† In much the same way as used by McCoy (*Amer. Chem. J.*, 1900, **23**, 353) and Ludlam (T., 1902, **81**, 1193).



for weighing, a cork is inserted in the mouth of the boiler, and T_1 is opened to admit dry air, drawn in through drying tubes connected at G . Hygroscopic solvents are thus protected.

Vapour escapes by the tube K , of length as short as possible, connexion with the condenser being made at a third ground joint, so that the molecular-weight tube, together with the thermometer and escape tube, can be lifted away bodily for weighing, during which process the tap T_2 is closed. A small cork may be inserted at E if desirable, and complete protection from moist air thus secured.

Of other points it may be remarked that the molecular-weight tube is graduated with marks 2 mm. apart to assist in determining the correction for the use of boiling point due to increasing head of liquid (alternatively the graduation may be in c.c.); that the thermometer used is one of the Beckmann type specially made by Baumbach, of Manchester; and that it is advantageous to protect the cylindrical portion of the outer jacket by two or three thicknesses of asbestos paper, and so diminish the loss of heat by radiation.

The following results were obtained during the course of little more than an hour from the time of setting up the apparatus:

Pyrogallol in Ethyl Alcohol. $C_6H_3(OH)_3 = 126.0$.

Weight of Solute, 0.8090 gram.

Weight of solvent. Grams.	Δ° .	M. W.
9.69	0.773	124.9
11.90	0.625	125.7
14.31	0.530	123.7
16.71	0.444	126.1
19.17	0.399	124.0
21.92	0.332	128.3
23.96	0.277	128.4
Mean		125.9

Seven readings did not mark the limit of the capabilities of the apparatus with this solvent, and as no more than five could, as a rule, be obtained with the earlier form, the efficiency of the new apparatus is considerably greater. Ethyl ether, carbon disulphide, and water are easier to handle than alcohol, and with them quite a long series of readings is obtainable. When, however, the boiling point of the solvent exceeds 100° , the number of readings becomes less, so that with amyl alcohol, for example, only four readings were obtained. Above 150° the apparatus may conveniently be employed only in measurements where it is sufficiently accurate to assume that the volume of the solution is the volume of the solvent;

for in such a case it is unnecessary to detach the molecular-weight tube, thus avoiding the inconvenience of handling it at a high temperature.

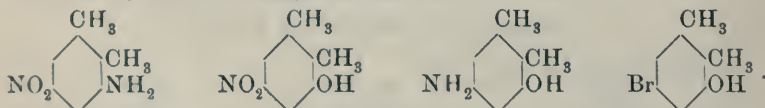
For a discussion of the details requiring attention and the corrections to be applied in accurate work, reference should be made to the previous paper on the subject.

313. "The optical rotatory power of derivatives of succinic acid in aqueous solutions of inorganic salts. Part I." By George William Clough.

The specific rotations of *d*-tartaric acid, methyl *d*-tartrate, ethyl *d*-tartrate, and *d*-tartramide respectively have been measured at various temperatures in aqueous solutions of sodium and barium haloids. The values obtained are in all cases lower than those for the corresponding aqueous solutions. The results were discussed from the point of view of Armstrong and Walker's hypothesis (*Proc. Roy. Soc.*, 1913, *A*, **88**, 388).

314. "Derivatives of *o*-xylene. Part VI. 5-Bromo-*o*-3-xyleneol." By Arthur William Crossley.

5-Bromo-*o*-3-xyleneol has been synthesised by a series of reactions indicated by the following formulæ:

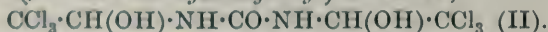


It crystallises from light petroleum (b. p. 40—60°) in radiating clusters of glistening needles, melting at 84°, and is identical with the bromoxylenol, of similar melting point, obtained by the action of phosphorus pentabromide on dimethyldihydroresorcin (*T.*, 1903, **83**, 128).

The *benzoyl* derivative crystallises in rhombic plates, melting at 98°, and the *o*-nitrobenzoyl derivative separates from alcohol in transparent needles, melting at 128°.

315. "The condensation of chloral hydrate and carbamide." By Noel Guilbert Stevenson Coppin and Arthur Walsh Titherley.

The two derivatives obtained by Jacobsen (*Annalen*, 1871, 157, 246) in the condensation between chloral hydrate and carbamide are β -trichloro- α -hydroxyethylcarbamide, $\text{CCl}_3\cdot\text{CH}(\text{OH})\cdot\text{NH}\cdot\text{CO}\cdot\text{NH}_2$ (I), and di(β -trichloro- α -hydroxyethyl)carbamide,



They are formed by a reversible change whenever the reactants are

present in equimolecular proportion in aqueous solution; with concentrated solutions the compound (I) greatly predominates unless a mineral acid catalyst is present, which favours the production of (II). When one molecular proportion of chloral hydrate acts on two of carbamide, however, the formation of the compound (II) is prevented, unless a mineral acid is present. Both substances are slowly hydrolysed into chloral hydrate and carbamide on heating with water. Thus, in 50 per cent. aqueous solution at 70°, β -trichloro- α -hydroxyethylcarbamide suffers decomposition to the extent of about 50 per cent. in an hour. The mixture which separates on cooling contains about 70 per cent. of compound (I), and 30 per cent. of compound (II).

In the reversible system:

water + β -trichloro- α -hydroxyethylcarbamide \rightleftharpoons

chloral hydrate + carbamide,

the true equilibrium is virtually never reached, owing to continual formation of di(β -trichloro- α -hydroxyethyl)carbamide, which, being nearly insoluble, separates out.

β -Trichloroethylidenecarbamide, $\text{CCl}_3\cdot\text{CH:N}\cdot\text{CO}\cdot\text{NH}_2$ (m. p. 234°), is readily obtained from β -trichloro- α -hydroxyethylcarbamide by the action of acetic anhydride on its solution in alkali.

Trichloroethylidenedicarbamide, previously obtained by Pinner and Lifschütz (*Ber.*, 1887, **20**, 2346) from chloralcyanohydrin and carbamide, is produced slowly when β -trichloro- α -hydroxyethylcarbamide is heated at 100° with carbamide and acetic anhydride.

316. "The action of amino-acid esters on ethyl dicarboxyglutaconate." By Stanley Isaac Levy.

The reaction between ethyl dicarboxyglutaconate and organic derivatives of ammonia, which has been investigated by Ruhemann and his pupils, has now been extended to α -amino-acid esters. It has been found to apply generally to compounds of this class, and derivatives have been prepared from the esters of glycine, alanine, aminobutyric and aminoisobutyric acids, and leucine. With the exception of the first member of the series, *ethyl glycylmethylenemalonate*, $\text{CO}_2\text{Et}\cdot\text{CH}_2\cdot\text{NH}\cdot\text{CH}\cdot\text{C}(\text{CO}_2\text{Et})_2$, which is a colourless solid, these compounds are yellow, viscous oils; in chemical behaviour they closely resemble ethyl aminomethylenemalonate. Thus they are easily decomposed by acids or alkalis, and are not reduced by the zinc-copper couple; when heated with aniline, they yield the monoanilide of ethyl anilinomethylenemalonate.

317. "The relationship between the absorption spectra and the constitution of ketones and their derivatives." Part I. By George Gerald Henderson, James Alexander Russell Henderson, and Isidor Morris Heilbron.

The authors have re-examined the absorption spectra of a series of carefully purified aliphatic ketones, and have found that the characteristic absorption band of acetone is shown by all these compounds, and that the persistence of the band is in each case fully equal to that of the acetone band.

In order to account for these and other facts the authors suggest that the selective absorption of ketones is due to intramolecular vibrations caused by the momentary formation of unstable ring systems through the agency of free "partial valencies," which, under certain conditions, make their appearance on the atoms of the carbonyl group.

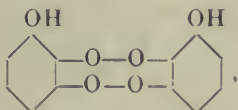
318. "Note on purpurogallin."

By Arthur George Perkin.

In view of the fact that the author has been engaged for a long time with the study of purpurogallin (Perkin and Steven, T., 1903, **83**, 192; 1906, **89**, 802; A. G. and F. M. Perkin, *ibid.*, 1904, **85**, 243; 1908, **97**, 1186; A. G. Perkin, P., 1905, **21**, 211; T., 1912, **101**, 803; 1913, **103**, 661), the recent paper of Nierenstein and Spiers (*Ber.*, 1913, **46**, 3151) requires comment. These authors, who have repeated the earlier work of Perkin and Steven (*loc. cit.*), already partly confirmed by Herzig (*Monatsh.*, 1910, **31**, 799), with identical result, claim to have established the presence of four hydroxyls in this compound, notwithstanding the fact that tetra-acetylurpurogallin, monoacetylurpurogallin trimethyl ether (*loc. cit.*, 1903), and purpurogallin tetramethyl ether (*loc. cit.*, 1905) have been prepared. Although acetylurpurogallin was described as yellow by Nietzki and Steinmann (*Ber.*, 1887, **20**, 1277) and Perkin and Steven (*loc. cit.*), Herzig isolated this compound in the colourless condition, whereas Nierenstein and Spiers can only prepare an orange-yellow product. A colourless substance can, however, easily be obtained by crystallising from benzene with animal charcoal, although in the author's experience this purification is much more difficult to effect with acetic acid or alcohol. It is interesting to note that no distinction in melting point can be observed between the yellow and colourless preparations, from which it appears possible that the pure acetyl compounds exists in two forms. Thus purpurogallin, regenerated from the latter

variety, on reacetylation with acetic anhydride and pyridine yields the usual yellow product, which shows the same behaviour with solvents.

Nierenstein and Spiers refer also to the compound $C_6H_4O_3(?)$, first prepared by the oxidation of pyrogallol by means of *isoamyl* nitrite (*loc. cit.*, 1906), but more recently by means of *p*-benzoquinone (*loc. cit.*, 1913), which yields purpurogallin among other products when digested with boiling water. By the *p*-benzoquinone method (20 grams of pyrogallol, 6 grams of *p*-benzoquinone and 15 c.c. of absolute alcohol), the yield of 0.51 gram, although larger than that given by *isoamyl* nitrite (0.27 gram), is so small that in the hope of the discovery of a better process which, however, has not been forthcoming, the author until recently hesitated to prepare a quantity of the material by these expensive methods. Although it suggested itself as possible that the production of this compound from pyrogallol was in reality due to the presence of traces of a second compound in this substance, this seems not to be the case, because pyrogallol, when submitted to the action of zinc dust and dilute acid, still reacts in the same way with *p*-benzoquinone. Whereas the constitution at first preferred for the compound $C_6H_4O_3(?)$ was that of a hydroxy-*o*-benzoquinone, Willstätter and Müller (*Ber.*, 1911, **44**, 2180) consider this to be unlikely, and further work now in progress favours the second or peroxide formula:



already alluded to in the earlier communication.

Nierenstein and Spiers have again examined the product of the distillation of purpurogallin with zinc dust, although Nietzki and Steinmann and also Perkin and Steven obtained naphthalene thereby, and it has been very recently shown that by the reduction of purpurogallone both β -naphthol and 2:3-dihydroxynaphthalene can be produced. If purpurogallin, as now seems probable, is in reality a naphthalene derivative, the simple expression $C_{10}H_4(OH)_4CO$ is only available for it. In such a case it has suggested itself to the author among other considerations that the

o-quinonoid grouping, $\begin{array}{c} \diagup \\ C:CH \cdot OH \\ | \\ C:(O) \end{array}$ is present, because the isomeric

purpurogallone derived from it by the action of alkali at a high temperature, which has the properties of a trihydroxynaphthalene-carboxylic acid, can thus be regarded as a product of simultaneous

oxidation and reduction. Such a grouping would also account for the comparative resistance of the fourth hydroxyl in purpurogallin to methylation, and again, the formation of the colourless acetyl and tetramethyl derivatives could be explained on the assumption that these exist in the tautomeric hydroxy-aldehydic condition. A

formula involving the grouping $\begin{array}{c} \diagup \\ \text{C}:\text{CH}_2 \\ \diagdown \\ \text{C}:\text{O} \end{array}$ also suggests itself, and

these points are mentioned here in that the work on which the author is now engaged, and which consists mainly of a study of the oxidation of the purpurogallin methyl ethers, involving as it does the preparation of large quantities of material will occupy a considerable time.

319. "*l*-Epicamphor (*l*- β -camphor)."

By Julius Brecht and William Henry Perkin, jun.

A detailed description of work of which a preliminary account has already appeared (P., 1912, **28**, 56).

320. "The action of hydrogen peroxide on the sodium alkyl thiosulphates." By Douglas Frank Twiss.

Dibenzyl diselenide has been submitted to oxidation (both electrolytic and by hydrogen peroxide) in the hope of producing compounds of the selenoxide, selenone, or selenonium salt class (compare Fichter and Sjöstedt, *Ber.*, 1910, **43**, 3422), but the result of such treatment was to eliminate the selenium from the molecule either in the free state or as selenious acid.

In consequence of the lack of success attendant on experiments in this direction, the effect of oxidation of sodium or potassium alkyl selenosulphates was considered as a possible process for the achievement of the desired end. The action of hydrogen peroxide was therefore first tried with sodium alkyl thiosulphates, when it was found that in acid solution this process gives rise to excellent yields of the corresponding disulphides even at the ordinary temperature. Dibenzyl, di-*o*-nitrobenzyl, di-*p*-nitrobenzyl, and diallyl disulphides were prepared in this manner. Under similar treatment, potassium *o*-nitrobenzyl selenosulphate produced di-*o*-nitrobenzyl diselenide.

321. "Synthesis of *d*- and *l*-sylvestrene."

By Walter Norman Howarth and William Henry Perkin, jun.

A detailed description of work of which a preliminary account has appeared (P., 1910, **26**, 97; 1913, **29**, 223).

322. "Note on the configurations of the optically active normal secondary alcohols." By George William Clough.

Pickard and Kenyon have prepared ten optically active carbinols of the series $\text{CH}_3\cdot\text{CH}(\text{OH})\cdot\text{R}$ (the "methyl" series), eight of the series $\text{CH}(\text{CH}_3)_2\cdot\text{CH}(\text{OH})\cdot\text{R}$ (the "*isopropyl*" series), and thirteen of the series $\text{C}_2\text{H}_5\cdot\text{CH}(\text{OH})\cdot\text{R}$ (the "ethyl" series). The simplest carbinol of the "methyl" series and of the "ethyl" series is methylethylcarbinol. Pickard and Kenyon have made a comparison of the molecular rotatory powers of the dextrorotatory carbinols of the "methyl" and of the "ethyl" series, and have selected the dextrorotatory form of methylethylcarbinol for comparison with the dextrorotatory carbinols of both series (T., 1911, **99**, 45; 1912, **101**, 620; 1913, **103**, 1923).

Although it is impossible to state with certainty that the carbinols possessing the same sign of rotation are configuratively similar, it appears highly probable that in the case of the higher members of a series similarity of sign does indicate similarity of configuration. The assumption may therefore be made (and the course of the curves for the molecular rotations strongly supports this view) that in the "methyl" series where $\text{R} > \text{CH}_3$ (that is, in all cases), and in the "ethyl" series where $\text{R} > \text{C}_2\text{H}_5$, similarity of sign of rotation accompanies similarity of configuration. Moreover, if the two series of carbinols, $\text{CH}_3\cdot\text{CH}(\text{OH})\cdot\text{R}$ and $\text{C}_2\text{H}_5\cdot\text{CH}(\text{OH})\cdot\text{R}$, are compared, it appears exceedingly probable from a consideration of the curves representing the molecular rotations in the homogeneous state, in benzene solution and in ethyl-alcoholic solution respectively, that the higher dextrorotatory carbinols of the "methyl" series are configuratively similar to the dextrorotatory carbinols of the "ethyl" series. Thus, if $\text{R} > \text{C}_2\text{H}_5$, the corresponding dextrorotatory carbinols of the two series may be configuratively represented by the formulæ:

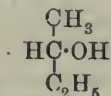


d-"Methyl" series.



d-"Ethyl" series.

The simplest optically active members of the *d*-"methyl" and *d*-"ethyl" series may therefore be represented by the formulæ:



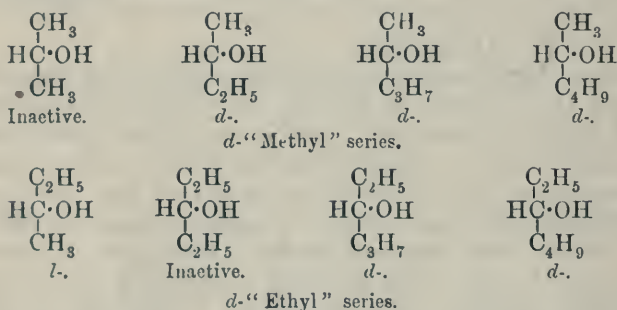
d-"Methyl" series.



d-"Ethyl" series.

In other words, the simplest member of the *d*-“methyl” series is the optical antipode of the simplest member of the *d*-“ethyl” series. The assumption which has already been made that similarity of sign in the “methyl” series always indicates similarity of configuration leads to the view that *d*-methylethylcarbinol is the simplest optically active member of the *d*-“methyl” series. Consequently, *l*-methylethylcarbinol is the first optically active member of the *d*-“ethyl” series. We therefore arrive at the apparent paradox that the simplest members of the two configuratively similar series are enantiomorphic forms of the same substance.

The earlier members of the *d*-“methyl” and *d*-“ethyl” series may be represented thus:



In the “ethyl” series, for the first member $R < \text{C}_2\text{H}_5$, for the second $R = \text{C}_2\text{H}_5$, whilst for the other members $R > \text{C}_2\text{H}_5$. It is therefore not surprising that there should be a change of sign in the passage from the first to the third member of this series.

The view here advanced is confirmed by reference to the curves of Pickard and Kenyon (T., 1913, **103**, 1924, 1926, 1929). The curves in Figs. 1 and 2 for the molecular rotations of the *d*-“ethyl” series show a marked abnormality in the case of the first member. If the value for *l*-methylethylcarbinol is substituted for that of the *d*-carbinol, the curves exhibit much greater regularity. The curve (Fig. 4) for the *d*-“methyl” series shows no abnormality in the first member, for *d*-methylethylcarbinol has the same configuration as the other *d*-carbinols of this series.

Attention may also be drawn to the values for the molecular rotation of the hydrogen phthalic esters of the dextrorotatory carbinols, $\text{C}_2\text{H}_5 \cdot \text{CH}(\text{OH}) \cdot \text{R}$, in ethyl-alcoholic solution. The value for the rotation of the ester with $R = \text{CH}_3$ is $[\text{M}]_D + 86.5^\circ$, with $R = \text{C}_3\text{H}_7$, $[\text{M}]_D + 9.42^\circ$, whilst with $R = \text{C}_4\text{H}_9$, $[\text{M}]_D + 52.3^\circ$. It is evident that the value for the ester of *l*-methylethylcarbinol should be compared with those for the esters of the dextrorotatory carbinols of the “ethyl” series (compare Fig. 1, *loc. cit.*).

The temperature-coefficients for the rotations of the two series of *d*-carbinols are also of interest in this connexion. The specific rotations of the dextrorotatory alcohols of the methyl series (including *d*-methylethylcarbinol) diminish with rise of temperature (T., 1911, **99**, 50), whereas the values for the dextrorotatory carbinols (up to ethyl-*n*-nonylcarbinol) increase with rise of temperature, with the exception of *d*-methylethylcarbinol. If the view is accepted that *l*-methylethylcarbinol is the first member of the *d*-“ethyl” series, the temperature-rotation curves for the earlier members of this series are similar in character.

These considerations show the impossibility of expressing the relative configurations of a series of optically active compounds by the designations *d* and *l*.

323. “The surface tension of mixtures. Part I. Mixtures of partly miscible liquids and the influence of solubility.” By Ralph Palliser Worley.

Experiments were made with the object of throwing light on peculiarities noticed in the surface tensions of weak solutions of some liquids which are only partly miscible with water.

The surface tension was measured by means of the capillary rise method, the liquids examined being aniline, phenol, and *iso*-butyl alcohol. The decrease of the solubility of aniline in water produced by the addition of common salt had the effect of greatly lowering the surface tension, the final value being not far above that of pure aniline. In the case of aniline and phenol the surface tensions of some of the more concentrated solutions rose with increasing temperature, whilst the surface tensions of none of the solutions, not even the weakest, fell normally, that is, similarly to that of a pure liquid. On the other hand, the surface tension of all solutions of *isobutyl* alcohol fell regularly.

This difference of behaviour has been accounted for by the different behaviour exhibited towards water with increase of temperature. Whereas the solubility of aniline and phenol increases with rise of temperature, the solubility of *isobutyl* alcohol decreases up to 75°, and then increases rapidly until the critical solution temperature is reached. These results point to the fact, therefore, that the low surface tension of solutions of partly miscible liquids is due to the lack of solubility of the solute. The reason of this is that liquids when near their limit of solubility form solutions which are rather of the nature of colloidal than of true solutions.

324. "The surface tension of mixtures. Part II. Mixtures of perfectly miscible liquids and the relation between their surface tensions and vapour pressures." By Ralph Palliser Worley.

A relation exists between the surface tension and the vapour pressure of a liquid. The object of the present research was to find out whether in mixtures of liquids deviations from a general law governing vapour pressures were accompanied by corresponding deviations in the case of surface tensions.

The following mixtures were examined: (1) *Benzene and Ethylene Dichloride*.—The surface tensions were found to agree with those calculated from the admixture rule. So also do the vapour pressures agree with those calculated (Zawidski). (2) *Carbon Disulphide and Acetone*.—The surface tensions were found to be below the calculated values, and the curve to tend towards a minimum. The vapour pressures are much greater than those calculated, and the curve passes through a maximum. (3) *Acetic Acid and Pyridine*.—The surface tensions were much greater than those calculated, and the curve tended towards a maximum value. The vapour pressures are much below those calculated, and the curve forms a minimum.

It seems therefore that when a mixture obeys one admixture rule it obeys the other also; when the surface tensions are greater than those calculated the vapour pressures are less, and vice versa.

Additional proof was given by mixtures of benzene and carbon tetrachloride, and the homologous series of alcohols and water.

From experiments with sulphur and carbon disulphide, it appears that the relations hold good for all mixtures.

325. "The tautomerism of thioanilides."

By Percy May.

Although the thioanilides are usually represented as thioketones, $R \cdot NH \cdot CS \cdot R'$, yet in many respects they react as iminomercaptans, $R \cdot N : C(SH) \cdot R'$. The methyl derivatives corresponding with both forms were prepared in the case of thiobenzanilide and thioacetanilide, and their absorption spectra were compared with those of the parent substances in the light of Thiele's theory of "conjugated" unsaturated linkings. When thiobenzanilide was subjected to the action of methylating agents in neutral solvents, the sulphur was eliminated as methyl sulphide.

N-Methylthiobenzanilide was obtained by the action of phosphorus sulphide on methylbenzanilide, and crystallises from alcohol in small, yellow cubes, melting at 90—91°.

S-Methylthiobenzanilide was obtained by the action of methyl sulphate on thiobenzanilide in alkaline solution, and crystallises from aqueous alcohol in colourless needles, melting at 63—64°.

326. "The determination of viscosity."

By Malcolm Percival Applebey.

In reply to the criticism of Bingham (T., 1913, **103**, 959), the author discussed the phenomena of flow in the Ostwald viscometer and the experimental conditions requisite for obtaining accurate determinations.

327. "Lead cyanide."

By Nalini Mohan Gupta.

According to Rammelsberg (D.R.-P. 139456), the compound $\text{Pb}(\text{CN})_2$ is formed by precipitating a solution of a lead salt with aqueous hydrocyanic acid or a soluble cyanide, whereas Kugler (*Annalen*, 1848, **66**, 63) states that a basic salt, $\text{Pb}(\text{CN})_2 \cdot 2\text{PbO} \cdot \text{H}_2\text{O}$, is formed by precipitation from an ammoniacal solution. It appears, however, to be generally recognised that the precipitate formed by the interaction of cyanides and lead salts in aqueous solution varies in composition with the concentration of the solutions employed, a fact which the author has confirmed.

Lead cyanide was decomposed by hydrogen sulphide, and the hydrogen cyanide was led into water through a U-tube containing lead cyanide. To remove any traces of hydrogen sulphide from the aqueous hydrocyanic acid, some lead cyanide was added to it, and the solution shaken. As no trace of hydrogen sulphide was present no lead sulphide was formed; but after filtering this solution it was found that it contained a considerable quantity of lead. It was evident that lead cyanide, which is not appreciably soluble in cold water, is soluble in aqueous hydrocyanic acid, and it was expected that this solution would, on evaporation, deposit pure lead cyanide free from oxide.

About 250 c.c. of a 5 per cent. solution of hydrocyanic acid were heated to boiling with a small quantity of precipitated lead cyanide under reflux. After about half an hour the solution was filtered and allowed to evaporate slowly in a desiccator. The deep yellow, needle-shaped crystals which separated were collected and dried in a vacuum.

Lead cyanide, even when powdered, appears to be unattacked by concentrated nitric and sulphuric acids in the cold. On adding water to a crystal, the insoluble oxycyanide is formed, and the water becomes cloudy.

A weighed quantity of the substance was heated for some hours to 120° ; there was no loss in weight.

For the estimation of cyanogen and lead a weighed quantity of the substance was heated in a water-bath in a sealed tube with a weighed excess of silver nitrate and a little nitric acid. The silver cyanide was collected and weighed. The silver remaining in solution was precipitated and weighed as silver chloride, which served as a check on the weight of the silver cyanide. Finally the filtrate was evaporated with sulphuric acid, and the lead sulphate weighed. Two different samples were analysed:

I. 0.1838 gave 0.1883 AgCN and 0.2137 PbSO_4 . $\text{CN}=19.90$;
 $\text{Pb}=79.42$.

II. 0.2272 gave 0.2340 AgCN and 0.2638 PbSO_4 . $\text{CN}=20.00$;
 $\text{Pb}=79.32$.

$\text{Pb}(\text{CN})_2$ requires $\text{CN}=20.07$; $\text{Pb}=79.92$ per cent.

The crystals consisted therefore of lead cyanide having the formula $\text{Pb}(\text{CN})_2$.

328. "Contributions to the theory of solutions. The intermiscibility of liquids. By John Holmes.

The relative solubilities of liquids have been correlated with their molecular volumes as ascertained by a method (previously described) based on the deviations observed in the additive relations of mixtures of liquids.

On the assumption that a pure liquid consists of a collection of like spherical molecules, it is deduced that any liquids, the molecular spheres of which have equal radii, should be miscible in all proportions. In binary mixtures this mutual miscibility continues until the ratio of the respective radii reaches 1.618, when the border line of partial miscibility is reached. When the ratio is greater than this value, the mixture separates into layers, in each of which the distribution of molecules is dependent on the further change in this ratio until it reaches 2.414, beyond which the liquids should be immiscible.

The curves of volume change calculated from densities available for various mixtures of liquids have been drawn, and the molecular volumes deduced from the ascertained complexities are compared with those required theoretically, on the above hypothesis, for their relative solubilities. The molecular complexities found for these liquids differ from those generally accepted, but the corresponding molecular volumes approximate closely to solubility requirements, and render it probable that the intermiscibility of liquids is a

function of molecular volume and independent of chemical constitution.

The experimental data include densities at 15° of mixtures of *isobutyric* acid with water, ethyl tartrate with water, and ethyl tartrate with glycerol; also densities at 25° of mixtures of chloroform with *n*-amyl alcohol and acetone. The critical temperatures of solution were determined for nicotine and water, and for carbon disulphide and ethyl tartrate when mixed in the proportion of one to two molecules (liquid) respectively. Volume changes in aqueous ethyl alcohol mixtures are compared with the corresponding differences from the theoretical values for refractive indices.

329. "A contribution to the study of the constitution of the methyl pentoses. Part I. The synthesis of an *i*-methyl tetrose and an *i*-methyl tetritol." By Robert Gilmour.

An account was given of the isolation of an inactive *methyl tetrose* by reducing dihydroxyvalerolactone with sodium amalgam in acid solution. The free sugar has been prepared, and found to be a strongly reducing pale yellow syrup.

Methyl tetrosazone forms pale yellow needles, melting at 140—142°. *Methyl tetrosephenylbenzylhydrazone* forms colourless needles, melting at 99—100°. It was shown that the reduction of dihydroxyvalerolactone yields as the main product a *methyl tetritol*, along with only a small amount of the tetrose. The *tetra-benzoyl* derivative of methyl tetritol melts at 136—137°. In addition the methyl tetritol has been oxidised by Fenton's method to the methyl tetrose, which was isolated in the form of the phenylbenzylhydrazone.

A racemic *brucine* salt of the *methyltetronic acid* was also described (m. p. 180—181°) as well as a *dimethoxyvalerolactone* (m. p. 59—60°), which was obtained by methylating dihydroxyvalerolactone.

Further, an account was given of a method which it is proposed to adopt for the preparation of other methyl tetroses, and their importance as a means of determining the constitution of naturally occurring methyl pentoses was indicated.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Moureu, *Charles*. Notions fondamentales de chimie organique. 4th edition. Paris 1913. pp. vi + 383. 9. Fr. (*Recd.* 26/11/13.)

From the Publishers: Messrs. Gauthier-Villars.

Tilden, *Sir William Augustus*. The progress of scientific chemistry in our own times. With biographical notes. 2nd edition. London 1913. pp. xii + 366. 7s. 6d. net. (*Recd.* 24/11/13.) From the Author.

II. *By Purchase.*

Rambousek, *J.* Industrial poisoning from fumes, gases and poisons of manufacturing processes. Translated and edited by *Thomas M. Legge*. London 1913. pp. xiv + 360. 12s. 6d. net. (*Recd.* 29/11/13.)

The next Ordinary Scientific Meeting will be held on **Thursday, December 18th, 1913, at 8.30 p.m.**, when the following papers will be communicated:

"Chemical examination of Sarsaparilla root." By F. B. Power and A. H. Salway.

"Aromatic compounds obtained from the hydroaromatic series. Part III. Bromoxyleneols from dimethyldihydroresorcin." By A. W. Crossley and N. Renouf.

"The equilibrium of dilute hydrochloric acid and gelatin." By H. R. Procter.

"Metallic derivatives of acetylacetone and acetyl mesityl oxide." (Preliminary note.) By G. T. Morgan and H. W. Moss.

"Constitution of the ortho-diazoimines. Part IV. Isomeric benzenesulphonyl-3:4-tolylenediazoimides." By G. T. Morgan and G. E. Scharff.

"Organic derivatives of silicon. Part XXI. The condensation products of diphenylsilicanediol." By R. Robison and F. S. Kipping.

"Sorption of gases by celluloid." By V. Lefebure.

"A study of the constitution of the nitrogen and phosphorus oxides and some of their derivatives by means of molecular volumes." By G. Le Bas.

"The absorption spectra of sulphurous acid and sulphites." (Preliminary note.) By R. Wright.

"An adiabatic calorimeter." By F. W. Gray.

"The distillation of coal in a vacuum." By M. J. Burgess and R. V. Wheeler.

"The composition of coal." By D. T. Jones and R. V. Wheeler.

"*iso*Melamine." (Preliminary note.) By H. Krall.

"Fluorone derivatives. Part II. Resorcinol-benzein." By F. G. Pope.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 29.

No. 422.

Thursday, December 18th, 1913, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Reference was made to the death, on December 4th, 1913, of Mr. Christer Peter Sandberg, of Westminster, who was elected a Fellow on March 3rd, 1870.

Messrs. H. F. Tayler, A. O. Blackhurst, V. Lefebure, C. J. Dickenson Gair were formally admitted Fellows of the Chemical Society.

Certificates were read for the first time in favour of Messrs.:

Ethelbert William Blair, B.Sc., 70, Fountayne Road, Stoke Newington, N.

Richard Charles Denington, 69, Dover Road, S. Wanstead, N.E.

John Garth, 170, St. Thomas's Road, Preston.

Ivan Richard Gibbs, B.A., University Hall, 3, Moors' Gardens, Chelsea, S.W.

Theophilus Harper, 39, Camden Street, Belfast.

William Pawson Robson, B.A., Ph.D., 78, Rolland Street, Cape Town.

Chandra Bhusan Roy, M.A., Patna College, Moradpore, P.O., Bankipore.

M. R. Viswanatha Tyer, 50, Prem Chand Bural Street, Bow-Bazar, Calcutta.

The PRESIDENT announced that, at the request of the International Committee on Physico-Chemical Nomenclature, the Council invited criticism of the symbols recently suggested by the International Association of Chemical Societies. For these symbols Fellows were referred to the Proceedings, Vol. 29, p. 333, and were requested to forward any suggestions to Professor A. Findlay, University College, Aberystwyth, before February 28th, 1914.

The announcement was also made that, in order to give Fellows more frequent opportunity of meeting informally, the Rooms of the Society would be opened on January 15th, 1914, at 8 p.m., when the President and Council would be glad to meet the Fellows of the Society. Smoking will be permitted, and light refreshments will be provided. Fellows were also invited to exhibit apparatus or specimens of interest and to show experiments; those willing to do so were requested to communicate with the Secretaries before the Monday previous to the Meeting.

Of the following papers, those marked * were read:

***330. "Absorption of gases by celluloid."**
By Victor Lefebure.

An absorption of gases by celluloids of a magnitude comparable with the sorption of gases by some charcoals has been observed by the author, and the chief points already established are as follows.

The effect is reversible. It is not chemical, in that no compound with a very low or with a moderately large dissociation pressure is formed, assuming that such compounds would not form solid solutions with the celluloid. It is common to all the kinds of celluloid examined, but almost vanishes when a precipitate of celluloid constituents is substituted for film celluloid. The property is recovered by the refilmed precipitate. Again, it is not exhibited by the two chief constituents of the celluloid, camphor and nitro-cellulose. Finally, the effect increases with lowering of temperature and raising of pressure, and in general nature resembles a case of sorption.

The quantitative experiments which have been carried out are concerned with time, diffusion, and equilibrium. The equilibrium experiments yield isotherms of the type given by previously examined sorption effects. The time experiments, yielding curves representing rates of sorption, indicate the possibility of a development of surface within the celluloid mass, and probably near to the external visible surface. The diffusion experiments have merely established the fact of diffusion through films.

DISCUSSION.

Professor DONNAN wished to congratulate the author on the excellent way he had carried out the work. He thought that Mr. Lefebure's paper was the first investigation of that nature on a semi-solid colloidal film.

The great rapidity of the initial absorption of the carbon dioxide by the celluloid, and the fact that the speed of absorption increased much more rapidly (per unit of weight of celluloid) than the increase of apparent (external) surface of the film, showed that in the mass of the celluloid or perhaps in the neighbourhood of the surface there was a very fine-grained macro-porosity into which the gas could rapidly penetrate and be adsorbed. Diffusion of the gas into or through molecular pores was simply what one called solution, and, so far as one knew, solution phenomena in semi-solid gels were relatively slow at the temperatures at which Mr. Lefebure had worked.

Solution and diffusion in the ordinary sense probably also occurred in the case of the celluloid films, and accounted for the later portions of the velocity curves.

Very little was known concerning the macro-heterogeneity of the camphor-nitrocellulose system, but Mr. Lefebure's work was an important contribution to the subject.

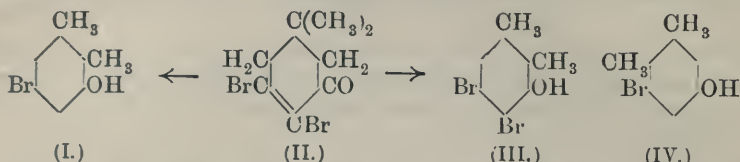
Mr. W. P. DREAPER pointed out that it was possible to vary the porosity of structureless cellulose filaments within wide limits by varying the strain under which they were dried at the time of manufacture. It might be possible to utilise this in determining the effect of porosity on the adsorption of gases by this material, and in this way confirm, or otherwise, some of the conclusions arrived at by the author. From this point of view it was strange that the precipitated cellulose gave a lower result, as it would certainly expose a considerable surface to the gas, and be relatively porous.

- *331. "Aromatic compounds obtained from the hydroaromatic series. Part III. Bromoxyleneols from dimethyldihydroresorcin." By Arthur William Crossley and Nora Renouf.

In continuation of the work, of which a preliminary note has appeared (P., 1912, 28, 332), the following rearrangements of hydroaromatic to aromatic substances have been established:

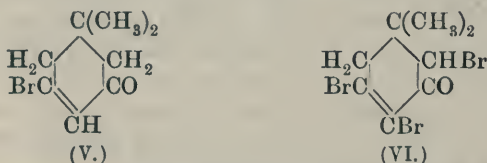
- (1) Under the influence of alcoholic potassium hydroxide

dibromodimethylcyclohexenone (II) gives 5-bromo-*o*-3-xenol (I) melting at 84° and 4:5-dibromo-*o*-3-xenol (III) melting at 97°:



(2) Heat causes the elimination of hydrogen bromide from dibromodimethylcyclohexenone, with production of 5-bromo-*o*-3-xenol and 6-bromo-*o*-4-xenol (IV) melting at 103°.

(3) Bromine acts on bromodimethylcyclohexenone (V) to yield, in the first place, a mixture of hydroaromatic substances, which on heating loses hydrogen bromide to give 5-bromo-*o*-3-xenol and 6-bromo-*o*-4-xenol:



(4) Tribromodimethylcyclohexenone (VI) under the influence of heat or alcoholic potassium hydroxide yields 4:5-dibromo-*o*-3-xenol and other bromoxylenols, which, up to the present, it has not been found possible to separate in a pure state.

***332. "The equilibrium of dilute hydrochloric acid and gelatin."**

By Henry Richardson Procter.

The author referred to a previous paper (*Koll. Chem. Beihefte*, 1911, 2, 243), in which it was shown that the swelling of gelatin in dilute acids, and the amount of acid absorbed, can be explained on the current hypothesis of chemical affinity and osmotic pressure. Precise mathematical expressions for these relations were now given, and it was shown that the two basic affinity-constants of gelatin being known, together with molecular weight, and a small correction for original alkalinity, its whole behaviour with regard to dilute acids can be prognosticated. The mathematical relations are quite general and applicable to other amphoteric proteins and other acids and their salts, and all the concentrations in the jelly were shown to be mathematical functions of the concentrations of the equilibrium-acid only, and not dependent on the chemical character of the protein. Gelatin appears to be diacid as a base, with hydrolysis constants $K_1=0.0013$, $K_2=1.05$, and an

approximate molecular weight of 839, leading to the formula $C_{35}H_{57}O_{13}N_{11}$.

Some difficulties in the applications of the electrometric method to colloidal equilibria were mentioned, and it was pointed out that in consequence of surface-potentials the ionic concentrations measured with the concentration-cell in colloid solutions are not those of the colloid solution itself, but of the acid or other solution with which it would be in equilibrium. Suggestions were made with regard to the probable colloidal structure of protein jellies and solution. A graphic geometrical method was described for dealing with all such equilibria as depend on the "equality of products."

DISCUSSION.

Professor DONNAN thought that the methods of investigation employed by Professor Proctor were the right ones, and would lead him eventually to a solution of his problems.

He observed that the author inclined to the view taken by Arrhenius in his work on immunity, namely, to treat the phenomena as cases of molecular equilibrium, without much reference to adsorption and colloidal aggregation and disaggregation.

Nevertheless in his (Professor Donnan's) opinion both series of phenomena occurred, and must be taken into account.

He would refer Professor Proctor to the work of two Italian investigators, an account of which was to be found in the *Nernst Festschrift*.

***333. "Researches on residual affinity and co-ordination. Part I. Metallic acetylacetonates and their absorption spectra." By Gilbert T. Morgan and Henry Webster Moss.**

An examination of the absorption spectra of fourteen metallic acetylacetonates in alcoholic solution showed that, with the exception of the chromium compound, all these substances exhibit a well-marked absorption band in the ultra-violet.

Chromic acetylacetone showed a band of this character, but in addition a well-defined band toward the red end, probably due to the metallic radicle. Comparative experiments were made on the volatility of scandium and thorium acetylacetonates under the ordinary and under 8—10 mm. pressure.

***334. "Ionisation and the law of mass action. Part II. The osmotic data in relation to combined water." By William Robert Bousfield.**

It was shown by reference to the figures for sucrose that the osmotic data can be brought into accurate conformity with the gas

equation by taking account of the combined water. The osmotic pressure equation, vapour-pressure equation, and freezing-point equations then present themselves in the following forms:

$$O.P. \text{ equation } P/R'\theta (h-n)=i$$

$$V.P. \quad , \quad \rho \delta p/p (h-n)=i$$

$$F.P. \quad , \quad \Delta/F'' (h-n)=i,$$

where h is the total number of molecules of water per mol. of solute and n is the number of combined molecules of water per mol. of solute.

DISCUSSION.

Professor DONNAN thought that there were some misconceptions in the paper. There was absolutely no a priori reason to "expect" the equation $PV=RT$ to hold for more concentrated solutions.

The general theoretical osmotic equation for solutions of any strength was now well known. If, however, there was practically no volume or energy-change on solution, this equation, as was well known, reduced to a simple form for solutions of any concentration. If solvation occurred, then, of course, in relatively concentrated solutions allowance had to be made for it.

The calculations of Mr. Bousfield might serve to show that after this allowance had been made aqueous solutions of sucrose of very considerable concentration approximated to the "simple" behaviour referred to above. In Professor Donnan's opinion this suggestion had been made by previous authors.

335. "Chemical examination of sarsaparilla root."

By Frederick Belding Power and Arthur Henry Salway.

The material used for the present investigation consisted of grey Jamaica sarsaparilla root, such as is recognised by the British Pharmacopœia.

The root was found to contain a small amount of an enzyme, which slowly hydrolysed amygdalin.

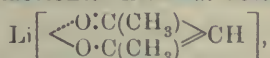
An alcoholic extract of the root yielded, besides a little essential oil, the following definite compounds: (i) a crystalline glucoside, sarsasaponin, $C_{44}H_{76}O_{20} \cdot 7H_2O$, which, on hydrolysis, is resolved into sarsasapogenin, $C_{26}H_{42}O_3$, and dextrose; (ii) sitosterol-*d*-glucoside (phytosterolin), $C_{53}H_{96}O_6$; (iii) sitosterol, $C_{27}H_{46}O$; (iv) stigmasterol, $C_{30}H_{50}O$; (v) a new crystalline dicarboxylic acid, *sarsapic acid*, $C_6H_4O_6$ (m. p. 305°), which yields a *dimethyl* ester, $C_8H_8O_6$, melting at 121° ; (vi) dextrose; (vii) a mixture of fatty acids, consisting of palmitic, stearic, behenic, oleic, and linolic acids. The alcoholic extract contained, furthermore, a small quantity of a substance which possessed the characters of cetyl-*d*-glucoside, and

a considerable quantity of potassium nitrate was also present. The amount of resinous material was equivalent to about 1.25 per cent. of the weight of root employed.

It has now been shown that Jamaica sarsaparilla root contains but one definite saponin glucoside, namely, sarsasaponin, and it is considered probable that the "parillin" of previous investigators was a mixture of sarsasaponin and a phytosterolin. It has also been definitely ascertained that the so-called "smilacin" ("smila-saponin" of v. Schulz) is not a homogeneous substance, but contains a relatively small proportion of sarsasaponin, together with amorphous material.

336. "Metallic derivatives of acetylacetone and acetyl mesityl oxide." (Preliminary note.) By Gilbert Thomas Morgan and Henry Webster Moss.

Series 1.—With the exception of copper, the metals of the first vertical series of the periodic classification yield somewhat unstable derivatives with acetylacetone. *Lithium acetylacetone*,

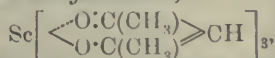


a colourless, crystalline mass, decomposed when dissolved in the ordinary organic media, the solutions assuming a yellow colour.

Caesium acetylacetone, a colourless, crystalline mass soluble in water or alcohol, was much less stable than the preceding compound. Silver acetylacetone, obtained as a white, crystalline precipitate, rapidly darkened on exposure, with liberation of silver; it is sparingly soluble in water; the solution rapidly deposited a silver mirror. The blue copper acetylacetone yielded a green additive compound with quinoline.

Series 2.—Zinc acetylacetone, formerly described as a yellow substance, was obtained in colourless, acicular prisms, soluble in hot water or alcohol. Its cadmium analogue was much less soluble.

Series 3.—*Scandium acetylacetone*,

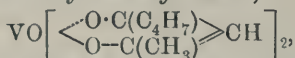


melting after sublimation at 187—187.5°, crystallised from benzene in colourless, tabular prisms, or from chloroform in square plates. It was prepared by the interaction of scandium nitrate, acetylacetone, and ammonia. The molecular weight determined by the ebullioscopic method corresponded with the above formula.

Comparative experiments made with yttrium, erbium, and thorium indicate that the acetylacetones of scandium and yttrium

(the two rare earth metals of least atomic weight) do not under similar experimental conditions yield additive ammonia compounds comparable with those obtained from acetylacetones of the rare earth metals of higher atomic weight.

Series 5.—*Vanadyl acetyl mesityl oxide*,

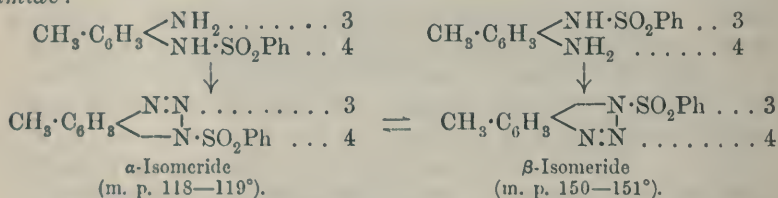


prepared by the interaction of vanadyl sulphate, acetyl mesityl oxide, and ammonia, crystallised from light petroleum in grass-green leaflets.

Other metallic derivatives of acetyl mesityl oxide are under examination; they are characterised by their ready solubility in organic solvents, including light petroleum.

337. "Constitution of the ortho-diazoimines. Part IV. Isomeric benzenesulphonyl-3:4-tolylenediazoimides." By Gilbert Thomas Morgan and Godfrey Edward Scharff.

3-Nitro-*p*-toluidine and 4-nitro-*m*-toluidine (m. p. 111—112°), the latter base prepared from either *m*-cresol, *m*-toluidine, or diacetyl-2:5-tolylenediamine, were converted respectively into the isomeric 4-benzenesulphonyl-3:4-tolylenediamine and 3-benzenesulphonyl-3:4-tolylenediamine. These acylated ortho-diamines yielded the corresponding isomeric diazoimides, 4-benzenesulphonyl-3:4-tolylenediazoimide and 3-benzenesulphonyl-3:4-tolylenediazoimide:

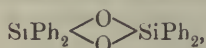


The α -isomeride is a more soluble, labile modification, which on prolonged boiling in solution changes almost completely into the less fusible, more sparingly soluble, stable β -isomeride.

338. "Organic derivatives of silicon. Part XXI. The condensation products of diphenylsilicanediol." By Frederic Stanley Kipping and Robert Robison.

The study of the four condensation products of diphenylsilicanediol previously described (Kipping, T., 1912, 101, 2125) has been continued in order to ascertain the conditions under which each is formed.

The results seem to show that diphenylsilicone, SiPh_2O , the analogue of benzophenone, is not produced by the dehydration of diphenylsilicanediol, and that the closed-chain compound,

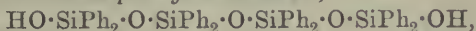


is not formed by the dehydration of anhydrobisdiphenylsilicanediol.

In the presence of piperidine, solutions of diphenylsilicanediol and of anhydrobisdiphenylsilicanediol both give tetra-anhydrotetrakisdiphenylsilicanediol, and probably also some trianhydrotris-diphenylsilicanediol.

Dianhydrotrisdiphenylsilicanediol may be obtained by carefully hydrolysing trianhydrotrisdiphenylsilicanediol with alkali in ethereal acetone solution; it is very rapidly converted into trianhydrotrisdiphenylsilicanediol in methyl-alcoholic solution in the presence of a little hydrochloric acid. Trianhydrotrisdiphenylsilicanediol is also formed when anhydrobisdiphenylsilicanediol is treated with a methyl-alcoholic solution of hydrochloric acid, but the reaction takes place slowly.

Trianhydrotetrakisdiphenylsilicanediol,



the most complex open-chain condensation product so far obtained, may be prepared by very cautiously hydrolysing the tetra-anhydro-derivative with sodium hydroxide in chloroform solution; it melts at 127° , and is easily converted into the tetra-anhydro-derivative by traces of sodium hydroxide in alcoholic solution.

339. "The absorption spectra of sulphurous acid and sulphites." (Preliminary note.) By Robert Wright.

While comparing the absorption spectra of various acids with their salts, it was found that whilst the absorption of sulphurous acid is characterised by a band in the ultra-violet, the sodium salt exhibits only general absorption. It is thought that this is most probably due to a difference in structure between the acid and its salt, additional evidence in favour of this view being the fact that whilst the acid has the properties of a moderately strong acid, its salt suffers hydrolysis in aqueous solution, thus behaving like a derivative of a weak acid.

A parallel case is to be found in the behaviour of chromic acid and its salts, where a strong acid differs in visible colour from its salts, the latter also being hydrolysable.

340. "An adiabatic calorimeter." By Francis William Gray.

The author described a water mantle, the temperature of which can be altered at will to prevent radiation inwards to or outwards from the calorimeter. The temperature is raised by pumping water from a hot bath through a flexible copper tube immersed in the water of the mantle. The temperature is lowered by passing tap-water through the same flexible copper tube, or, if necessary, by pumping water from a cold bath through the flexible tube. The flow of water is controlled by a system of two T-tubes and four taps. With this apparatus any rate of rise or fall of temperature likely to be required in thermochemical work can be obtained. A turbine stirrer is used for the mantle water.

341. "The distillation of coal in a vacuum."

By Maurice John Burgess and Richard Vernon Wheeler.

An account was given of distillations of coal in a high vacuum at low temperatures, and the apparatus used described.

The gaseous products of distillation only were discussed in detail, the liquid products being dealt with in a subsequent paper.

The sequence of events when coal is gradually raised in temperature in the absence of air was described, and it was shown that of part of the coal substance a decomposition point occurs at about 350°.

Fractionation of the gases by means of liquid air and solid carbon dioxide dissolved in ether was stated to have enabled propane and butane to be isolated, and the presence of pentane established by explosion analysis.

342. "The composition of coal."

By David Trevor Jones and Richard Vernon Wheeler.

An account was given of an examination of the liquid products of distillation of coal in a vacuum at low temperatures, from which conclusions were drawn regarding the composition of the "resinous substances" that form part of the coal conglomerate.

A description was given of the various compounds contained in the oils obtained, which consisted largely of unsaturated (ethylenic) hydrocarbons, naphthenes, paraffins, phenols (chiefly cresols and xyenols), and homologues of naphthalene. Benzene, anthracene, and solid aromatic hydrocarbons were stated to be absent.

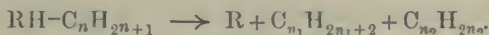
The presence or absence of free hydrocarbons in any quantity in coal was discussed, and an hypothesis put forward to account

for the rapid formation of paraffins, naphthenes, etc., on distilling coal at low temperatures. It was suggested that such hydrocarbons must be present in the coal substance in such a manner that whilst, in a sense, structurally complete, some change in their state, such as can be produced by moderate heating, must take place before they can be set free.

This hypothesis, particularised for the case of the paraffins, assumes their existence in coal as alkyl groups attached chemically to another non-alkyl group, $R \cdot H$, the paraffin being in what can be termed a "bound" condition, as a component part of a molecule represented by the general formula $RH - C_nH_{2n+1}$. The rapid distillation of "free" paraffins from these "bound" molecules when coal is decomposed thermally was then explained according to the following scheme:



or

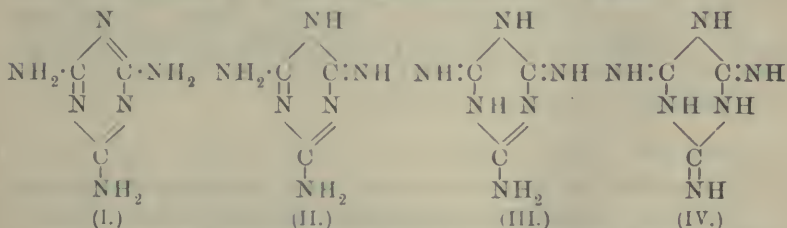


With certain modifications the hypothesis was used to explain the appearance of naphthenes, olefines, and naphthalene homologues in coal distillates.

343. "*iso*Melamine." (Preliminary note.)

By Hans Krall.

Four isomerides of melamine are theoretically possible:



Only one of these, usually assumed to be (I), is known. Two series of alkylmelamines are known, and are usually assumed to be derived from (I) and (IV). During an investigation of the action of heat on guanidine salts, a second melamine has now been obtained; it is probably formed by the polymerisation of cyanamide in its carbodi-imide phase, $\text{NH}:\text{C}:\text{NH}$, and may be assumed for the present to be the hitherto unknown *isomelamine* (IV).

When guanidine carbonate is heated for three hours at 180° , the residue consists of a mixture of ammeline and a substance which analysis shows to be isomeric with melamine. The former is readily dissolved by cold aqueous sodium hydroxide.

isoMelamine crystallises from water in ill-defined crystals, quite unlike the characteristic prisms of its isomeride. The two substances can be crystallised side by side from the same solution, so that the difference is constitutional, and not merely crystallographic.

isoMelamine gives rise to a chloride, nitrate, and sulphate of melamine, so that strong acids cause isomerisation. The true *acetate* can be obtained from which alkalis regenerate unaltered *isomelamine*.

Alkalis do not affect the constitution, but they induce hydrolysis more rapidly than with the normal isomeride.

At about 260° the compound decrepitates, and passes into the more stable form.

Both compounds are being further studied.

344. "Fluorone derivatives. Part II. Resorcinol-benzein."

By Frank George Pope.

Resorcinol-benzein, as prepared by Doebner's method, consists essentially of 3-hydroxy-9-phenylfluorone. Confirmation of this result was shown by its conversion into the sodium and barium salts, and by the preparation of the acetyl derivative, whilst by the action of phosphorus pentachloride it yields 3:6-dichloro-9-phenylxanthonium chloride identical with the product of the reaction between 3-hydroxy-9-phenylfluorone and phosphorus pentachloride. The different varieties of resorcinol-benzein as described by H. v. Liebig (*J. pr. Chem.*, 1912, [ii], 85, 97, 241) were not obtained, neither were the anhydro-compounds described by the same author in 1908 (*ibid.*, 78, 534).

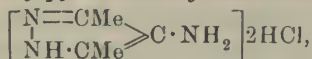
345. "The relation between viscosity and chemical constitution. Part VIII. Some homologous series." By Albert Ernest Dunstan, Ferdinand Bernard Thole, and Percy Benson.

The authors have continued their work on the additive nature of log. viscosity, and have examined the viscosity of ninety-three compounds drawn from the homologous series of the fatty acids, alcohols, ethyl and methyl esters of the fatty acids, and esters of methylethylcarbinol, hexan- β -ol, heptan- β -ol, octan- β -ol, and undecan- β -ol.

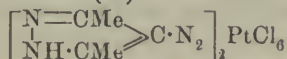
They find in each series that log. viscosity is additive within limits, but that the CH_2 differences vary with (1) association, (2) magnitude of the group to which the growing chain is attached, (3) molecular weight, (4) temperature.

346. "Non-aromatic diazonium salts. Part III. 3:5-Dimethylpyrazole-4-diazonium salts and their azo-derivatives." By Gilbert T. Morgan and Joseph Reilly.

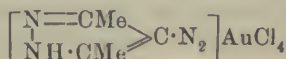
4-Amino-3:5-dimethylpyrazole dihydrochloride,



can be diazotised quantitatively to a stable, very soluble diazonium chloride, which has been characterised by conversion into the moderately soluble *platinichloride* (I) and the sparingly soluble *aurichloride* (II):



(I.)



(II.)

Addition of sodium azide to the acid solution of diazonium chloride determines at once the liberation of diazo-nitrogen and the production of 4-*triaz*o-3:5-dimethylpyrazole, a distinctly basic compound, which is precipitated only on neutralising the solution with sodium carbonate.

3:5-Dimethylpyrazole-4-diazonium chloride is even more stable than the corresponding salt from diazotised 4-aminoantipyrine; it is not readily decomposed by boiling aqueous potassium iodide, and its capacity for azo-coupling is retained after treatment with alkali carbonates, hydroxides, thiocyanates, and cyanides.

3:5-Dimethylpyrazole-4-azo- β -naphthol dissolves very sparingly in aqueous alkali hydroxides, but is insoluble in water.

3:5-Dimethylpyrazole-4-azo- β -naphthylamine is a pale orange-brown base.

347. "The relative activities of certain organic iodo-compounds with sodium phenoxide. Part IV. The influence of the solvent." By David Segaller.

The velocity-coefficients of the reaction between sodium phenoxide and ethyl and propyl iodides have been measured with the view of studying the influence of the solvent in this reaction.

The following solvents were employed: methyl alcohol, ethyl alcohol, propyl alcohol, *isobutyl* alcohol, *isoamyl* alcohol, and acetone.

It was shown that there is no connexion in this reaction between the dielectric constant of the solvent and the influence of the latter on the rate of the reaction. The influence of the medium is very large, the velocity-coefficient in acetone solution being more than one hundred times as large as that in *isoamyl* alcohol solution.

348. "The polysulphides of the alkali metals. Part I. The polysulphides of sodium." By Alexander Rule and John Smeath Thomas.

An investigation has been made of the action of sulphur on alcoholic solutions of anhydrous sodium hydrosulphide prepared by the method previously described by one of the authors (T., 1911, 99, 558). A vigorous reaction takes place between sulphur and the hydrosulphide in alcoholic solution, with the evolution of hydrogen sulphide and the formation of polysulphides.

Using amounts of sulphur corresponding with the di-, tri-, tetra-, penta-, and a possible hexa-sulphide, and concentrating the solution, a solid product was obtained, but only when the proportions of hydrosulphide and sulphur for the tetrasulphide were used was the product homogeneous. It consisted of the pure anhydrous tetrasulphide, which is a brownish-yellow substance, crystallising in well-defined cubes.

Below the proportions for the tetrasulphide, mixtures were obtained which contained unchanged hydrosulphide. At the penta-sulphide stage the solid product is a mixture of the tetrasulphide and sulphur, whilst above that stage there is some indication of the separation of a higher polysulphide.

The course of the reaction and the probable nature of the substances present in solution before evaporation of the latter was determined by estimating the amounts of hydrogen sulphide evolved when varying amounts of sulphur were used in the reaction.

Anhydrous sodium disulphide was also obtained by reducing solutions of the tetrasulphide with metallic sodium. It is a bright yellow, micro-crystalline powder, less soluble in alcohol than the tetrasulphide.

349. "Nitro-acids derived from 2:3-dimethoxybenzoic acid and 4-methoxyphthalic acid." By John Cannell Cain and John Lionel Simonsen.

5-Nitro-2:3-dimethoxybenzoic acid was prepared by nitrating 2:3-dimethoxybenzoic acid and also by nitrating 2:3-dimethoxytoluene and oxidising the 5-nitro-2:3-dimethoxytoluene formed.

6-Nitro-2:3-dimethoxybenzoic acid (Wegscheider and Klemenc, *Monatsh.*, 1910, 31, 709) was synthesised as follows: 3-Hydroxy-o-tolyl methyl ether on nitration yields 5:6-dinitro-3-hydroxy-o-tolyl methyl ether, which on methylation and reduction gives 2-nitro-5:6-dimethoxy-m-toluidine. On elimination of the amino-group the resulting 6-nitro-2:3-dimethoxytoluene furnishes, on oxidation, the required acid.

The nitration of 4-methoxyphthalic acid yields a mixture of 3- and 5-nitro-4-methoxyphthalic acids, which can readily be separated. The former was also synthesised by oxidising 1-nitro-2-naphthyl methyl ether, and the latter by oxidising 5-nitro-4-methoxy-o-xylene.

350. "The *p*-nitrobenzoates of borneol and isoborneol."

By George Gerald Henderson and Isidor Morris Heilbron.

In the course of investigations on the action of oxidising agents on camphene and on bornylene, the authors have more than once had some difficulty in deciding whether an alcohol present among the oxidation products was borneol or isoborneol. It is troublesome to obtain these compounds in a state of purity by crystallisation alone, and such of their hitherto described derivatives as are well characterised and easily prepared, for example, the hydrogen phthalates, melt at the same or very nearly the same temperatures. The authors therefore sought for some derivative of borneol and isoborneol by means of which the alcohols could be more easily distinguished from each other, and ultimately found that the *p*-nitrobenzoates, which can be prepared and purified without difficulty, meet this requirement.

For the preparation of the *p*-nitrobenzoates the following method gives good results: The calculated quantity of *p*-nitrobenzoyl chloride is added to a solution of the alcohol in ten to fifteen times its weight of pure pyridine, and the reaction, which starts immediately, is completed by warming the solution for an hour or two on the water-bath. The pyridine is then removed by cautious addition of dilute sulphuric acid, the flask being kept cool during this operation by immersion in ice-water, and the precipitated *p*-nitrobenzoate is collected, washed with dilute sulphuric acid and with water, dried, and crystallised from alcohol. Usually one crystallisation is sufficient.

Borneol p-nitrobenzoate, $\text{NO}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{CO}_2 \cdot \text{C}_{10}\text{H}_{17}$, crystallises from alcohol in minute, lustrous, colourless plates, which melt at 137° . It is sparingly soluble in cold alcohol, readily so in the other common organic solvents, and insoluble in water:

0.472 gave 19.1 c.c. N_2 (moist) at 13° and 754 mm. $\text{N}=4.74$.

$\text{C}_{17}\text{H}_{21}\text{O}_4\text{N}$ requires $\text{N}=4.62$ per cent.

isoBorneol p-nitrobenzoate separates from alcohol in fine, colourless needles, which melt at 129° . In solubility it closely resembles the corresponding borneol ester:

0.559 gave 22.5 c.c. N_2 (moist) at 12° and 760 mm. $\text{N}=4.78$.

$\text{C}_{17}\text{H}_{21}\text{O}_4\text{N}$ requires $\text{N}=4.62$ per cent.

The ultra-violet absorption spectra of these esters were found to be identical, each compound, in $M/10,000$ -solution, showing a shallow band with head at $1/\lambda$ 3080.

The esters are readily hydrolysed when heated with dilute aqueous sodium hydroxide under reflux. The liberated alcohols were distilled in a current of steam, collected, dried, and crystallised from light petroleum. The purified borneol was found to melt at 208° and the *isoborneol* at 217° ; the melting point of the former is the same as, but that of the *isoborneol* three degrees higher than, that formerly recorded.

351. "The identity of the supposed β -2:5-dimethylpiperazine."

By William Jackson Pope and John Read.

The authors have continued the examination of the substances described as α - and β -2:5-dimethylpiperazine, and now show that the behaviour of the β -isomeride can only be explained on the assumption that it is *cis*-2:4-dimethylpiperazine; it is further concluded that the α -compound is *trans*-2:5-dimethylpiperazine.

352. "Oxidation of the anhydrides of 1:1-dihydroxydinaphthyl-di-alkylmethanes." (Preliminary note.) By Hemendra Kumar Sen-Gupta.

This investigation has been undertaken with the object of ascertaining the constitution of some of the condensation products of α -naphthol with ketones, as also of synthesising some naphthaxanthone derivatives. The *anhydride* of β -1:1-dihydroxydinaphthyl-

propane, $\begin{matrix} \text{CH}_3 \\ \text{CH}_3 \end{matrix} > \text{C} < \begin{matrix} \text{C}_{10}\text{H}_6 \\ \text{C}_{10}\text{H}_6 \end{matrix} > \text{O}$, yields, on oxidation by chromic acid,

two products, namely, (i) an orange *compound*, $\text{C}_{24}\text{H}_{16}\text{O}_3$, crystallising in thin, soft needles, and melting at 287° ; and (ii) a golden-yellow *compound*, $\text{C}_{24}\text{H}_{16}\text{O}_4$, crystallising in lozenges and melting at 245° . The latter gives on reduction a *dihydroxy*-derivative, $\text{C}_{24}\text{H}_{18}\text{O}_3$ (m. p. $252-253^\circ$); its *diacetyl* derivative crystallises in needles and melts at $241-242^\circ$. The *anhydride* of γ -1:1-dihydroxy-

dinaphthylpentane, $\begin{matrix} \text{Et} \\ \text{Et} \end{matrix} > \text{C} < \begin{matrix} \text{C}_{10}\text{H}_6 \\ \text{C}_{10}\text{H}_6 \end{matrix} > \text{O}$, similarly yields a deep red *compound* crystallising in plates and melting at 221° . The constitutions of these products are being studied.

353. "The relation of uranous salts to thorium."

By Alexander Fleck.

If the electrons expelled in radioactive change arise from the same part of the atom in which the electrons governing electrochemical change of valency exist, it should follow that the chemical properties of the uranous and thorium ions are identical. By reducing a mixture of thorium and uranyl salts by nascent hydrogen and then treating the reduced liquid fractionally with a precipitant, it was found that although the properties of thorium and uranium in the quadrivalent condition are very similar, yet there is a distinct difference in their chemical nature, and they can be separated from one another by fractional precipitation. In carrying out the examination of their properties it was necessary that the precipitation, filtration, and other operations should be performed without air coming in contact with the reduced liquid.

As a result of these experiments the conclusion was drawn that the electric charges on the α - and β -particles must arise from the nucleus of the atom, and that electrons may be added to or withdrawn from the external ring of electrons, thereby increasing or diminishing the valency of the atom.

354. "The system : xylene-alcohol-water."

By Alfred Holt and Norman Murray Bell.

The authors have determined the data of the varying miscibility of xylene, alcohol, and water at different temperatures, also the position of the tie-lines which give the composition of the conjugate solutions.

The extent to which xylene is separated from its solution in alcohol by the addition of water has also been examined, as also the composition of mixtures of the three liquids which possess the same specific gravity.

355. "Interaction of glycerol and oxalic acid." *

By Frederick Daniel Chattaway.

The explanation usually given in the text-books of the reactions occurring when glycerol and oxalic acid are heated together, and commonly employed in the laboratory preparation of formic acid and of allyl alcohol, is fundamentally incorrect.

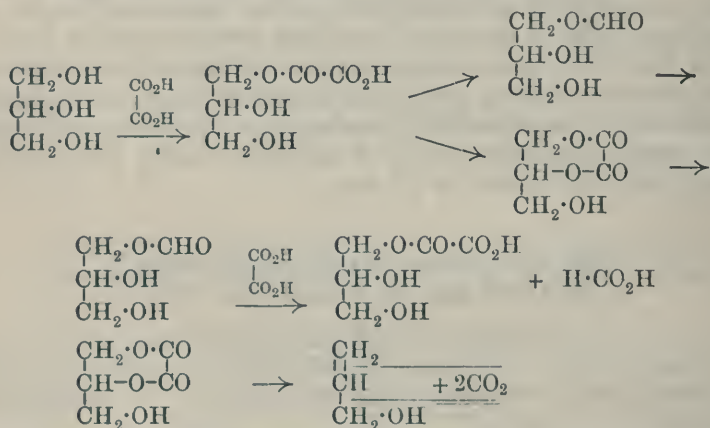
The true explanation is the obvious one. The oxalic acid acts on glycerol as it does on other alcohols, and produces an acid and

* This paper was read at the meeting on December 4th, 1913.

a normal oxalate. The former, like all such compounds, is unstable at a slightly elevated temperature, and decomposes when this is reached into carbon dioxide and monoformin. The fresh oxalic acid added displaces the formic acid from the latter, and the cycle of operations repeats itself.

The more complicated reaction which goes on when the first product of the interaction of glycerol and oxalic acid is rapidly heated, until evolution of carbon dioxide ceases and then at a much higher temperature recommences with simultaneous production of allyl alcohol, is the decomposition at the high temperature of the normal ester, which is produced from the acid ester by a repetition of the ester formation, into carbon dioxide and allyl alcohol.

The main reactions concerned in the production of formic acid and of allyl alcohol should therefore be formulated, thus:



and not as is at present invariably done.

The next Ordinary Scientific Meeting will be held on **Thursday**, January **22nd.**, 1914, at **8.30** p.m., when the following papers will be communicated:

"Crystals of organic compounds, coloured blue by iodine." By G. Barger and W. W. Starling.

"Organic derivatives of silicon. Part XXII. The siliconic acids." By C. J. Meads and F. S. Kipping.

"The mutual solubility of formic acid and benzene and the system: benzene-formic acid-water." By A. J. Ewins.

"The preparation and properties of pure formic acid." By A. J. Ewins.

"Loose compounds of cholesterol with barium methoxide." By E. Newbery.

"A study of the vapour pressure of nitrogen peroxide." By A. C. G. Egerton.

PROCEEDINGS
The Chemical Society

Vol XXX Nos 423-436
Jan. to Dec. 1914

Nos 423-432 are bound in this volume

Nos 433-436 with title-page and index
are bound at the end of Vol 105 II of
the Transactions for 1914.

The following Notice is printed at the
end of No 136:-

NOTICE

The Council have decided that the issue of
the Proceedings in their present form shall
cease with the present Number, which com-
pletes the thirtieth volume.

In future the Proceedings will be issued in
an abbreviated form along with the Journal,
but will be paged separately so that they may
be bound either with the Journal or separately.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

 Vol. 30

 No. 423.

Thursday, January 22nd, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society, through death, of:

	Elected.	Died.
William Popplewell Bloxam ..	Dec. 20th, 1883.	Dec. 26th, 1913.
John Gibson	June 16th, 1892.	Jan. 1st, 1914.

It was announced:

(a) That the Council desired to draw the attention of Fellows to the fact that the Faraday Society is prepared to consider the election to membership of a certain number of Fellows of the Chemical Society without the usual entrance fee.

(b) That Fellows may purchase the forthcoming Volume III. of the International Tables of Physical Constants and Numerical Data at the reduced prices of 19s. 3d. (unbound) or £1 2s. 3d. (bound). Application for this volume should be addressed to Dr. C. Marie, 9, Rue de Bagneux, Paris VI^e, before March 31st, 1914.

(c) That Volume II. of the Memorial Lectures delivered before the Chemical Society is now ready, and can be purchased from the Publishers or from the Assistant Secretary, price 6s. net.

The Council are considering the question of re-issuing Volume I. of the Memorial Lectures (now out of print), and it would be of

assistance to them if Fellows and others wishing to purchase it would send an intimation to this effect to the Assistant Secretary on the post-card which is issued with this number of the Proceedings.

Certificates were read for the first time in favour of Messrs.:

Sydney Edward Davenport, Fernbank, York Road, Windsor.
 Charles George Fernie, B.Sc., Holmleigh, Northwood, Middlesex.
 George Ingle Finch, 41, Ladbroke Road, W.
 Reginald Furness, M.Sc., 90, Woodlands Road, Ansdell, Lytham.
 Gopal Balkrishn Kolhatker, M.A., Ferguson College, Poona, India.

Frederic William Leighton, Lydiard Tregoze, Wootton Bassett, Swindon.

Rowland Ernest Oldroyd, 90, Park Road, Rochdale.

William Henry Pick, B.Sc., 141, Mare Street, Hackney, N.E.

Frederick Alfred Pickworth, 70, Highfield Road, Dartford.

Conly Hunter Riley, Anchorage, Clayton-le-Moors, Accrington.

Joseph de Carle Smith, B.Sc., Oak House, Newmarket Road, Norwich.

Horace Gilbert Stone, B.Sc., 24, High Street, High Wycombe.

A certificate has been authorised by the Council for presentation to ballot under Bye-law I (3) in favour of Mr. Lionel Cohen, Stock Department Laboratory, Casino, N.S.W.

Of the following papers, those marked * were read:

***1. "Crystals of organic compounds coloured blue by iodine."
 By George Barger and Walter William Starling.**

In a previous paper (Barger and Field, T., 1912, 101, 1396) it was pointed out that the blue compounds formed from various organic substances and iodine may be either amorphous or crystalline; the former cases are typical examples of adsorption. The blue crystals may be regarded as solid solutions of iodine in the organic substance, in proportions not necessarily stoichiometric. They only result when the crystal is formed in the presence of iodine, either from a solution containing iodine, or by sublimation in the presence of iodine (compare for analogous cases Bruni, *Feste Lösungen und Isomorphismus*, 1908, p. 95). Colourless crystals of the organic substance, when once formed, cannot be made to take up iodine. In most of the cases studied so far, the blue crystals have been obtained from solutions in mixtures of water with an organic solvent, but this need not be the case always; narceine,

for instance, when dissolved, together with iodine, in pyridine, gives rise to blue crystals on adding light petroleum. All the blue crystals examined so far are more or less strongly pleochroic; no connexion has been detected between the crystalline form and the capacity for yielding "mixed" crystals with iodine.

DISCUSSION.

In reply to the President, Dr. BARGER expressed the opinion that the additive compounds described might be analogous to oxonium compounds, but since they were also given by substances not containing a pyrone nucleus, they might possibly show greater analogy to the potassium additive compounds of ketones, described by Schlenk and Thal (*Ber.*, 1913, **46**, 2840). No analogous bromine compounds had been observed.

***2. "The mutual solubility of formic acid and benzene, and the system: benzene-formic acid-water." By Arthur James Ewins.**

Formic acid was found to be partly miscible with a number of organic liquids. The mutual solubility of formic acid with benzene was studied in detail.

The critical solution temperature (maximal) of these two liquids affords a very sensitive means of determining the purity of the components, and was therefore employed for this purpose. For the purification of formic acid, fractional distillation was employed, followed by careful fractional crystallisation, until the critical solution temperature with pure benzene remained constant (73.2°).

The acid so obtained melted at 8.39° , boiled at $100.47^{\circ}/760$ mm., and had D_4^{25} 1.2259. The acid showed very little supercooling on freezing, the actual figures in three determinations being 0.40° , 0.15° , and 0.35° .

Benzene was purified by fractional crystallisation and distillation from sodium. The melting point was found to be 5.57° . The ternary system benzene-formic acid-water was also studied.

***3. "The condensation of ethyl glutaconate." By Raymond Curtis and James Kenner.**

The condensation products isolated by Blaise (*Compt. rend.*, 1903, **136**, 639) and by von Pechmann (*Ber.*, 1904, **37**, 2113) from the action of sodium ethoxide on glutaconic ester were shown to be identical, and a probable constitution was assigned to them.

Certain discrepancies between the accounts given by the two investigators named were also examined.

α -Ethylglutaconic ester, after treatment with sodium ethoxide in the same manner as glutaconic ester, was recovered unchanged.

DISCUSSION.

Prof. J. F. THORPE stated that his experience with the behaviour of ethyl glutaconate on alkylation led him to think that the action of ethylene dibromide on this substance would most likely yield a derivative of *cyclopentane*, and not the *cyclopropane* derivative suggested by Dr. Kenner. It would be of great interest to apply this reaction to the case of ethyl β -methylglutaconate, the two forms of which were sufficiently stable to withstand ordinary experimental conditions.

Dr. KENNER, in reply, pointed out that Fecht had proved one of the products of the condensation of ethyl glutaconate with ethylene dibromide to be a *cyclopropane* derivative by the identity of its reduction product with a synthetic acid of known constitution.

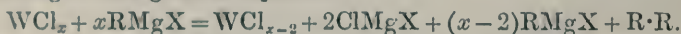
*4. "2-Hydrindamine."

By James Kenner and Annie Moore Mathews.

The preparation of 2-hydrindamine from ethyl hydrindene-2-carboxylate by Curtius's method was described, and the base was characterised by means of a number of derivatives.

*5. "An attempt to prepare organometallic derivatives of tungsten." By Eustace Ebenezer Turner.

It was shown that tungsten, in common with all elements situated in even series or in sub-group A of the periodic classification, cannot be converted into organo-metallic compounds by means of the Grignard reagent. The higher chlorides of tungsten are, instead, reduced, the chlorine removed decomposing the Grignard reagent to produce a mixed magnesium haloid salt and a hydrocarbon consisting of the two diaryl residues linked together, according to the general equation:



*6. "The absorption spectra of nitrated phenylhydrazones." By John Theodore Hewitt, Rhoda Marianne Johnson, and Frank George Pope.

The absorption spectra of the *p*-nitrophenylhydrazones of benzaldehyde and acetophenone have been measured. Addition of

alkali to the alcoholic solutions leads to salt-formation, accompanied by considerable change in the absorption spectra. The absorption of the two hydrazones mentioned is very similar to that of *p*-nitro-benzaldehydephenylhydrazone, although when the latter compound is acetylated, the absorption experiences a strong displacement towards the ultra-violet.

7. "Unstable compounds of cholesterol with barium methoxide."

By Edgar Newbery.

Barium oxide in presence of excess of methyl alcohol forms an unstable solid compound with cholesterol, which is dissociated in organic solvents, such as ether, benzene, etc., to an extent depending on the temperature and also on the concentration of the excess of methyl alcohol present, a state of equilibrium being set up between the cholesterol in the solid and that in the liquid. This state of equilibrium is attained much more rapidly when the compound is being decomposed than when it is forming. The compound is readily decomposed by water, carbon dioxide, or acetic acid. Hexadecyl alcohol shows a similar behaviour to cholesterol.

A knowledge of the above reactions is of importance when attempting to extract cholesterol and cerebroses by Smith and Mair's method (*J. Path. Bact.*, 1910, **15**, 122).

8. "A study of the vapour pressure of nitrogen peroxide."

By Alfred Charles Glyn Egerton.

Following some work on the vapour pressure of bromine, and in connexion with the measurement of small quantities of nitrogen peroxide, the vapour pressure of solid nitrogen peroxide has been investigated down to as low a temperature as -100° . The method employed in these measurements consisted in the saturation of a known volume of hydrogen, as it passed over the nitrogen peroxide, and the estimation of the amount of the latter carried over.

The measurements follow a certain curve which has a somewhat steeper slope than other measurements would appear to indicate, although these have not, so far, been carried below -35° . The vapour-pressure curve of nitrogen peroxide was discussed, and, with the aid of Nernst's vapour-pressure equation, approximate values of some of its chemical and physical constants were derived.

9. "Organic derivatives of silicon. Part XXI. The so-called siliconic acids." By Arthur James Meads and Frederic Stanley Kipping.

Many compounds supposed to have the structure $R \cdot SiO \cdot OH$ and to represent the silicon analogues of the carboxylic acids have been described in the literature. The first case was that of silicopropionic acid, $EtSiO_2H$ (Friedel and Ladenburg); shortly afterwards silicoacetic acid, $Me \cdot SiO_2H$, silicobenzoic acid, $Ph \cdot SiO_2H$, and silicotoluic acid, $C_6H_4Me \cdot SiO_2H$, were described by Ladenburg (*Annalen*, 1875, **179**, 143). In more recent times many other aliphatic and aromatic siliconic acids have been prepared by Khotinsky and Seregenkoff (*Ber.*, 1908, **41**, 2946), and by Melzer (*Ber.*, 1908, **41**, 3390).

Now the results of the study of the diarylsilicanediols, $R_2Si(OH)_2$ (Kipping, T., 1912, **101**, 2108, 2125; Robison and Kipping, *ibid.*, 2142, 2156), seemed to indicate that compounds of the type $RSi(OH)_3$ would not pass into siliconic acids, $R \cdot SiO_2H$, by loss of the elements of water, but would give rise to a series of condensation products, probably analogous to those of the diarylsilicanediols. An exhaustive examination of the so-called silicobenzoic acid has gone far to establish this view: the product of the hydrolysis of phenylsilicon trichloride is not one compound of the composition $C_6H_5 \cdot SiO_2H$, but a complex mixture of condensation products, primarily derived from the trihydroxy-derivative, $C_6H_5 \cdot Si(OH)_3$. It is very probable, therefore, that all the so-called siliconic acids are merely mixtures; the experiments are being continued in order to test this inference.

10. "The reactions of *isoamarine*." By Henry Lloyd Snape.

isoAmarine and methyl iodide react at the ordinary temperature, when benzene is employed as a solvent, with the production of the *methiodide*, $(C_{21}H_{18}N_2)_2 \cdot CH_3I$, which, on crystallisation from benzene, melts at 135° .

By the action of acetyl chloride on a solution of *isoamarine* in ethyl acetate or chloroform and heating the product with absolute alcohol, a crystalline substance, melting at $235-236^\circ$, was obtained, which proved to be an isomeride of the compound called "*diacetylamarine*" by Bahrmann, but shown by Japp and Moir (T., 1900, **77**, 636) to be acetylbenzoyldiphenylethylenediamine, $C_{23}H_{22}O_2N_2$, which melts at 316° . The six-sided plates mentioned in a former paper (T., 1900, **77**, 780) as having been obtained in small quantity as the result of the action of acetyl chloride on *isoamarine* followed by treatment with alcohol, proved to be *isoamarine* hydrochloride.

When *isoamarine*, dissolved in a very small quantity of glacial acetic acid, was treated with fuming nitric acid, a *mononitro*-derivative was obtained, which melted at 82—85°. Fuming nitric acid at 60° acted on *isoamarine*, forming a *dinitro*-derivative, which melted at 175—176°.

The values previously published for the rotation of *d*- and *l*-*isoamarine* and of the corresponding tartrates have been corrected.

Sulphates of *d*- and *l*-*isoamarine* were described. The former has the formula $(C_{21}H_{18}N_2)_2 \cdot H_2SO_4$, melts at 266—267°, and its rotatory power, $[\alpha]_D$, is +151.1° to +155.7°. The corresponding particulars with respect to the *lævo*-salt are $(C_{21}H_{18}N_2)_2 \cdot H_2SO_4 \cdot \frac{1}{4}H_2O$, 280—285°, and -144.1°. On addition of nitrosyl sulphate to *d*-*isoamarine* sulphate, a white, crystalline substance is precipitated which has the composition $(C_{21}H_{18}N_2)_2 \cdot H(NO)SO_4 \cdot \frac{1}{2}H_2O$.

11. "The constituents of *Solanum angustifolium*: isolation of a new gluco-alkaloid, *solangustine*." By Frank Tutin and Hubert William Bentley Clewer.

The material employed in this investigation consisted of the leaves, twigs, and flowers of *Solanum angustifolium*, Ruiz et Pavon.

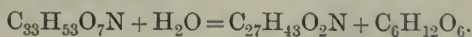
For the purpose of a complete examination, 30.92 kilograms of the dried and ground material were completely extracted with hot alcohol, and the resulting extract distilled with steam.

From the portion of the extract which was soluble in water, there were isolated the following substances: (i) quercetin; (ii) rutin; (iii) *l*-asparagine; (iv) a new gluco-alkaloid, *solangustine*, $C_{33}H_{53}O_7N \cdot H_2O$. The aqueous liquid also contained small amounts of an amorphous alkaloid and a considerable quantity of sugar, together with amorphous, viscid products which, on hydrolysis, yielded quercetin and 3:4-dihydroxycinnamic acid.

The portion of the extract which was insoluble in water yielded the following definite substances: (i) triacontane; (ii) a phytosterol, $C_{27}H_{46}O$; (iii) a phytosterolin (phytosterol glucoside), $C_{33}H_{56}O_6$; (iv) palmitic, stearic, cluytinic, and cerotic acids, together with a mixture of linolic and linolenic acids.

The *hydrochloride*, *nitrate*, and *sulphate* of *solangustine* are insoluble in water and most organic solvents. The last-mentioned salt forms colourless needles, and has the formula $(C_{33}H_{53}O_7N)_2 \cdot H_2SO_4 \cdot 3H_2O$.

On hydrolysis with dilute acid, *solangustine* yields *solangustidine*, $C_{27}H_{43}O_2N$, and dextrose:



Solangustidine is amorphous, but a crystalline *hydrochloride*,

hydrobromide, nitrate, sulphate, picrate, and acetyl derivative have been prepared from it.

The entire alcoholic extract of the plant, the new gluco-alkaloid, solangustine, and the amorphous, alkaloidal material were separately administered to a dog, but produced no appreciable physiological effect.

12. "Studies of the constitution of soap solutions: electrical conductivity of potassium salts of fatty acids." By Hugh Mills Bunbury and Herbert Ernest Martin.

The conductivities of the potassium salts (soft soaps) of the saturated fatty acids of even number of carbon atoms from the stearate to the acetate have been measured at 90° by the somewhat laborious method previously described by McBain and Taylor.

The conductivities of the potassium soaps are higher than those of the corresponding sodium soaps, but there is a general resemblance between the form and position of corresponding curves. Closer comparison shows an even greater tendency towards abnormality on the part of the potassium salts; this is not due to the potassium ion as such, for well-developed maxima and minima in the conductivity curves are exhibited from the stearate as far down as the laurate (C_{12}).

The appearance, washing power, density, and conductivity curve of potassium hexoate (C_6) distinctly mark the beginning of that deviation from the behaviour of the acetate, which rapidly and regularly increases through the other members of the homologous series until it attains the typical character of the higher soaps.

In all cases where it is directly visible, the depression in the conductivity curve occurs in the same region of concentration, independent of the nature of the acid or alkali taken. Further investigation may, however, show that the real abnormality is shifted in the case of the lowest homologues to regions of higher concentration.

13. "The system ethyl ether-water-potassium iodide-mercuric iodide. Part I. The underlying three-component systems." By Alfred Charles Dunningham.

The System: Potassium iodide-mercuric iodide-water.—This system has been studied at 20° and 30° . In both cases the following phases are stable in equilibrium with solution: KI , $KHgI_3$, $KHgI_3 \cdot H_2O$, HgI_2 .

The System: Potassium iodide-water-ethyl ether.—Ether and

water are only miscible to a small extent, and this is not materially increased by the addition of potassium iodide. Consequently it is possible to obtain: (1) A small range of homogeneous aqueous solutions in equilibrium with potassium iodide, (2) a small range of homogeneous ethereal solutions in equilibrium with potassium iodide, (3) one pair of invariant aqueous and ethereal solutions in equilibrium with one another and with potassium iodide, and (4) a wide range of conjugate aqueous and ethereal solutions in equilibrium with one another.

The System: Potassium iodide-mercuric iodide-ethyl ether.—The following phases are stable in equilibrium with solution: $KI-KHgI_3-HgI_2$. Under certain conditions a heavy liquid layer separates, rich in dissolved salts, and an equilibrium diagram has been constructed in which the saturation curves of potassium mercuri-iodide and mercuric iodide are cut by a binodal curve, so that each is divided into two portions, separated by a region in which all mixtures exist as two liquid layers.

The System: Mercuric iodide-water-ethyl ether.—Mercuric iodide is almost insoluble in water and ether and all mixtures of these two components. The equilibrium is of the same type as that in the system: potassium iodide-water-ethyl ether.

14. "The inversion of sucrose by acids in water-alcohol solutions." By George Joseph Burrows.

The rate of inversion of sucrose by acids in water-ethyl alcohol mixtures decreases with increasing concentration of alcohol up to 45—50 per cent., and then increases. The catalysis in such a series of solvents is therefore not proportional merely to the concentration of hydrogen ions. The catalytic activity of an acid is affected by the viscosity of the solution, and the influence of the latter is probably the same as in conductivity. If, therefore, the rates of inversion are divided by the conductivities of the acid in the different solvents, the numbers so obtained represent the relative catalytic activities of the acid. In this way it was found that the replacement of water by alcohol increases the catalytic activity of hydrochloric acid.

In the inversion of sucrose by acids, therefore, the addition of water may be regarded as decreasing the catalytic activity of the hydrogen ions. This agrees with results obtained by other authors for the anti-catalytic effect of the addition of water in esterification and similar catalytic reactions in alcohol.

15. "The volatile oil of *Cymbopogon coloratus* from Fiji."
By Ernest Goulding and John Campbell Earl.

The essential oils derived from certain species of *Cymbopogon* are well known in commerce as "lemon-grass" and "citronella" oils. The former are derived mainly from *Cymbopogon flexuosus*, Stapf, and *C. citratus*, Stapf, and the latter from *C. Nardus*, Rendle. The chief constituent of the lemon-grass oils is citral, the proportion of which is commonly between 70 and 80 per cent. The citronella oils, on the other hand, are characterised by the presence of considerable quantities of citronellaldehyde and geraniol, but contain very little or no citral.

In the course of a study of the various grass oils at the Imperial Institute, three oils have been encountered which have not hitherto been described, and exhibit characters very different from those of either the lemon-grass or citronella oils. One of these is furnished by the leaves of *Cymbopogon coloratus*, Stapf, and contains considerable quantities of citral and geraniol, but no citronellaldehyde.

In 1907, seeds of a lemon-grass were forwarded to Fiji from India, and the plant, since identified as *Cymbopogon coloratus*, Stapf, has been grown at Nasinu Experiment Station. It has been found by Knowles (*Bull. No. 6, Dept. Agric. Fiji*) that the fresh leaves of this grass, when distilled with steam, yield about 0.35 per cent. of oil. Samples of oil distilled in Fiji were forwarded to the Imperial Institute in 1908 and 1909, and were subjected to a preliminary investigation (*Bull. Imp. Inst.*, 1912, 10, 27). Subsequently the oil was examined by Umney (*Perfumery and Essential Oil Record*, Dec., 1912, 317), who found it to contain 35 per cent. of citral and 30 per cent. of geraniol. A further sample of the oil has been received recently from Fiji, and has been submitted to examination, with the following results.

The oil had D_{20}^{15} 0.912 and $[\alpha]_D$ at 24°, -10.31° , and contained 23 per cent. of geraniol (estimated by the phthalic anhydride method). It was shaken successively with sodium carbonate, sodium hydrogen sulphite, and sodium hydroxide, and the residual oil was afterwards submitted to fractional distillation. The sodium carbonate solution extracted 0.75 per cent. of the oil, consisting chiefly of acetic acid. The sodium hydrogen sulphite removed 34 per cent. of aldehydes, but some of the aldehyde remained in the residual oil (see below). The aldehydic constituents had a pleasant, lemon-like odour, and consisted almost entirely of citral. The treatment with sodium hydroxide extracted 0.75 per cent. of phenolic substances, from which a small quantity of a white, tasteless, and odourless solid (m. p. 142°, decomp.) was isolated;

the remainder consisted of a dark brown liquid with an odour recalling that of cloves, but the quantity was too small to admit of identification.

The residual oil still possessed a lemon-like odour, and an aldehyde estimation made by the sulphite method showed an absorption of 11 per cent. It furnished the following constants: D_{15}^{15} 0.915; α_D^{25} $-12^{\circ}29'$ (in 1-dcm. tube); ester value 42 (corresponding with 14.7 per cent. of geranyl acetate and equivalent to 9.5 per cent. in the original oil); saponification value after acetylation, 183 (corresponding with 43.4 per cent. of alcohols, calculated as $C_{10}H_{18}O$). On distillation under 10–12 mm. pressure, the following fractions were obtained:

Fraction.	Temperature.	Quantity, per cent.	D_{15}^{15}	Optical rotation, in 1-dcm tube.
A	up to 80°	8.3	0.858	$-52^{\circ}22'$
B	$80-105$	2.7	0.868	38 35
C	$105-120$	27.1	0.902	12 55
D	$120-130$	25.5	0.912	6 4
E	$130-150$	13.7	0.937	4 32
F	residue and loss	22.7	—	—

Fraction A consisted largely of terpenes. A further quantity of terpenes was obtained by distilling some of the original oil on the water-bath under 15–20 mm. pressure. By this means a fraction amounting to 7.4 per cent. of the original oil was obtained, which after repeated treatment with sodium and redistillation had D_{15}^{15} 0.854, α_D^{20} $-62^{\circ}39'$ (in 1-dcm. tube), and b. p. $168-173^{\circ}/760$ mm. The terpenes absorbed bromine to an extent corresponding with about three atoms per mol. $C_{10}H_{16}$, but the product could not be obtained in a crystalline state. It is probable that the terpenes were a mixture of *l*-limonene with one or more other terpenes, but the quantity of oil available was not sufficient to enable them to be identified.

Fraction B appeared to contain the constituents of A and C, and was not examined in detail.

Fraction C consisted chiefly of geraniol.

Fraction D contained more than 20 per cent. of esters. After hydrolysis, it yielded a homogeneous, crystalline diphenylurethane of geraniol (m. p. 82°). The readiness with which this derivative crystallised indicated the absence of citronelloldiphenylurethane.

Fraction E was readily soluble in less than three volumes of 70 per cent. alcohol (indicating the absence of sesquiterpenes), and furnished geranioldiphenylurethane (m. p. 82°).

The residue F was dark brown and viscous. When submitted to distillation in steam, about one-fourth of it distilled over; the remainder probably consisted of resinous, non-volatile, polymerisa-

tion products formed during the distillation and fractionation of the oil.

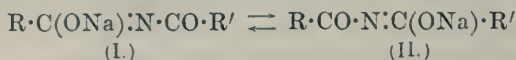
The results of this investigation indicate that the oil of *Cymbopogon coloratus* has the following approximate composition:

Terpenes	7.5 per cent.
Aldehydes, chiefly or entirely citral	40 "
Geraniol	23 "
Esters, chiefly geranyl acetate.....	10 "
Acetic acid	0.75 "
Phenols	0.75 "
Substances not identified	18 "

16. "The hydrolysis of mixed secondary amides by alkalis."

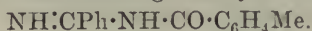
By Arthur Walsh Titherley and Leonard Stubbs.

A mixed secondary amide, $R \cdot CO \cdot NH \cdot CO \cdot R'$, under the influence of alkali, may conceivably suffer hydrolysis in two possible ways: (1) giving $R \cdot CO_2H$ and $R' \cdot CO \cdot NH_2$, or (2) giving $R \cdot CO \cdot NH_2$ and $R' \cdot CO_2H$. Direction (1) is followed exclusively when R' is an aromatic radicle and R is methyl, and this is attributed by the authors to steric influence. The mechanism of hydrolysis is probably one in which water-addition first takes place at the double link ($C:N$) of the tautomeric form of the secondary amide, yielding $R \cdot C(OH)_2 \cdot NH \cdot CO \cdot R'$, which then decomposes into the acid $R \cdot CO_2H$ and amide $R' \cdot CO \cdot NH_2$. Accordingly, in the equilibrium:



the rate of hydrolysis of I is very much greater than that of II, and owing to continual disturbance of the equilibrium it is the only form the hydrolysis of which can be detected. Whilst the hydrolysis of diacetamide, acetylcarbamide, and acetobenzamide in the cold is complete within forty minutes, that of purely aromatic secondary amides under the same conditions requires about fifteen hours. The influence of spacial protection on the course of the hydrolysis is illustrated by the fact that benzo-*o*-toluamide, $Bz \cdot NH \cdot CO \cdot C_6H_4 \cdot CH_3$, yields benzoic acid and *o*-toluamide exclusively, whilst benzo-*p*-toluamide decomposes in both possible ways, yielding a mixture of benzoic and *p*-toluic acids, together with benzamide and *p*-toluamide. Although steric influence is potent in directing the course of hydrolysis of a mixed secondary amide, evidence is available that the affinity for water of the double link ($C:N$) is also a factor. In the hydrolysis of acetylcarbamide, which yields acetic acid and carbamide almost quantitatively, it is probable that the form $CH_3 \cdot C(ONa):N \cdot CO \cdot NH_2$ only is involved. The two benzotoluamides above were obtained best by the condensation

of the corresponding phenyl toluates and benzamidine, and subsequent hydrolysis of the resulting toluoylbenzamidines,



17. The miscibility of azobenzene and azoxybenzene in the solid state and the supposed existence of a stereoisomeride of azobenzene." By Harold Hartley and John McArthur Stuart.

An examination of the freezing-point and melting-point curves of mixtures of azobenzene and azoxybenzene has shown that these substances form two series of mixed crystals with an eutectic temperature of 24.5° . The two mixed crystals deposited at this temperature contain respectively 45 per cent. and 90 per cent. of azoxybenzene molecules. The latter crystals are probably identical with the substance obtained by C. V. and R. A. Gortner (*J. Amer. Chem. Soc.*, 1910, **22**, 1294) as a by-product in the preparation of azobenzene by the distillation of azoxybenzene with iron filings, and thought by them to be a stereoisomeride of azobenzene.

18. "The influence of colloids and fine suspensions on the solubility of gases in water. Part IV. Solubility of nitrous oxide at pressures lower than atmospheric." By Alexander Findlay and Owen Rhys Howell.

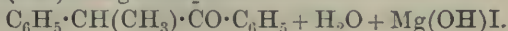
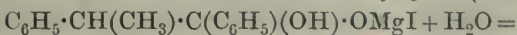
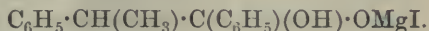
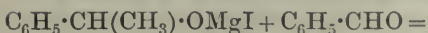
In continuance of previous work (T., 1910, **97**, 536), the solubility of nitrous oxide in water in the presence of ferric hydroxide, dextrin, starch, gelatin, egg-albumin, silicic acid, finely divided silica, and finely divided charcoal, has been determined at pressures lower than atmospheric. The values obtained fit in well with those previously obtained at higher pressures, and the general type of solubility curve obtained is similar to that found in the case of carbon dioxide (T., 1910, **97**, 536; 1913, **103**, 636); that is to say, the solubility curves show a more or less pronounced minimum.

19. "The action of aldehydes on the Grignard reagent." By Joseph Marshall.

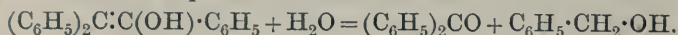
It has been found that the addition of two molecular proportions of benzaldehyde to one molecular proportion of magnesium methyl iodide results in the formation of α -methyldeoxybenzoin,



The course of this reaction is indicated by the equations:



A similar result was obtained when benzaldehyde was allowed to react with magnesium dimethylcarbinyl iodide, in which case phenyl *isopropyl* ketone was isolated. When, however, two molecules of benzaldehyde were caused to react with one molecule of magnesium phenyl bromide, the products of the reaction were benzyl alcohol and benzophenone, instead of phenyldeoxybenzoin (triphenylvinyl alcohol), as was expected. This result may be explained by assuming that the triphenylvinyl alcohol is hydrolysed under the conditions of the experiment as follows:



An analogous equation would explain the production of acetophenone when acetaldehyde is allowed to react with magnesium phenylmethylcarbinyl bromide.

An attempt was made to obtain phenylmethylacetaldehyde by allowing trioxymethylene to react with magnesium phenylmethylcarbinyl iodide, but the product of this reaction was phenylethyl iodide. Similar products were obtained when ethyl formate reacted with Grignard reagents, instead of the substituted acetic esters which were expected in these reactions.

20. "The use of sulphuryl chloride in the alkylation of phenols." By Wilhelmina Rebecca Smyth.

In view of the poisonous character of methyl sulphate, experiments have been carried out to ascertain whether it would be possible to use methyl alcohol and sulphuryl chloride in place of methyl sulphate as a methylating agent, and also whether other alcohols than methyl alcohol would react with phenols in the presence of sulphuryl chloride. The sulphuryl chloride was added to a slight excess of the alcohol, and when action was at an end the phenol was introduced. The mixture was allowed to remain for some time, and then treated gradually with a slight excess of alkali hydroxide. The ether formed was either extracted from the alkaline solution or removed by distillation in steam. In some cases before introducing the sulphuryl chloride the alcohol was treated with the calculated amount of metallic sodium, but this addition was not found to have any appreciable influence on the result. In other cases the sulphuryl chloride was cooled in a freezing mixture, and the alcohol slowly added, but here also the yields were not affected to any great extent.

The phenols treated in this way were phenol, catechol, carvacrol, and β -naphthol, the alcohols used being methyl and ethyl alcohol, and, in the case of the two last compounds, propyl alcohol. In all these cases alkylation occurs under the conditions just described,

but, except in the case of β -naphthol, the ethers are only formed in small amounts. β -Naphthol yields about half the calculated amounts of the methyl, ethyl, and propyl ethers. Phenol gave from 15 to 25 per cent. of anisole and phenetole, and catechol about 20 per cent. of guaiacol, but no veratrole. Carvacrol gave only traces of the methyl, ethyl, and propyl ethers. In most cases practically the whole of the unchanged phenol could be recovered from the alkaline solution.

Attempts to alkylate amino-compounds in a similar manner were not successful.

21. "The colours produced on mixing the alkyl nitrites with substances containing centres of residual affinity." By Ernest Magowan Harper and Alexander Killen Macbeth.

In view of the fact that many colour reactions have recently been obtained with the organic nitro-compounds, it appeared of interest to the authors to examine the alkyl nitrites. It was shown that these give colours with amino-compounds, ethylenic hydrocarbons and substances containing bivalent sulphur. These colours are similar to those obtained with tetranitromethane when treated with the same substances. It is thought probable that the colour is due to an intermediate additive compound, the true final additive compound being colourless. Parallel to this is the Vorländer hypothesis, which deals with such cases to account for the two products when an acid reacts with an $\alpha\beta$ -unsaturated ketone.

The final additive products of the nitrites and the primary, secondary, and tertiary amines have been isolated by Rây and Datta, Rây and Rakshit, and by Neogi, and the preparation of the corresponding compounds in case of the bivalent sulphur substances is being undertaken by the authors.

22. "The progressive bromination of toluene" By Julius Berend Cohen and Pavitra Kumar Dutt.

Cohen and Dakin (T., 1901, **79**, 1111) studied the progressive chlorination of toluene through successive stages from the hydrocarbon to the tetrachloro-derivatives. The results described by A. K. Miller (T., 1892, **61**, 1023) on the bromination of *o*- and *p*-bromotoluene present certain differences in the quantity and character of the products when compared with those obtained by chlorination of the corresponding chlorotoluenes. The authors have therefore submitted the subject to a careful investigation, in which they have determined the character of all the bromine deriv-

atives obtained by brominating the hydrocarbon and its mono- and di-bromo-derivatives.

The results of chlorination and bromination are given side by side in the following table for comparison, the principal product being placed first in each case, those occurring in smaller quantity standing next in order, whilst a trace is indicated by brackets.

Substance taken.	Bromination products.	Chlorination products.
Toluene	ortho, para, (meta)	ortho, para
Mono-halogen compounds {	Ortho 2 : 5, 2 : 4	2 : 4, 2 : 3, 2 : 6, (2 : 5)
	Meta 2 : 5, 3 : 4, (3 : 5)	2 : 5, 3 : 4
	Para 2 : 4, 3 : 4	2 : 4, 3 : 4
	2 : 3 2 : 3 : 6, 2 : 3 : 5	2 : 3 : 4
	2 : 4 2 : 4 : 5, (2 : 4 : 6)	2 : 4 : 5, 2 : 3 : 4, (2 : 4 : 6)
Dihalogen compounds {	2 : 5 2 : 4 : 5, (2 : 3 : 6)	2 : 3 : 6, 2 : 4 : 5
	2 : 6 2 : 3 : 6	2 : 3 : 6
	3 : 4 2 : 4 : 5, (3 : 4 : 5)	2 : 4 : 5
	3 : 5 2 : 3 : 5	2 : 3 : 5

Attention was directed to the difference in orienting effect produced by chlorination and bromination of the ortho-halogen derivatives, which is most marked in the case of the *o*-bromotoluene and in that of the 2:3- and 2:5-dihalogen derivatives.

23. "The absorption spectra of some mercury compounds."

By Cecil Reginald Crymble.

It has been shown that groups attached to the mercury atom increase its absorptive power in the following order: CN, Cl, $C_2H_3O_2$, $C_3H_5O_2$, Hg, Br, NO_2 , I; and that the absorption of the molecule depends on an interaction between the mercury atom and the attached groups.

Entrance of the mercury atom into complex haloid salts is accompanied by an increase in absorptive power. It is possible to determine the nature of the complex formed, and to follow its progressive dissociation on dilution. The complex $MHgX_3$ is formed quantitatively at decimolecular concentrations in alcohol. There is no spectroscopic evidence of the formation of any higher complex, such as M_2HgX_4 , in either alcohol or water.

The change in the properties of the mercury atom on passing from the dihaloid salt to the dialkyl compound has been compared with the corresponding change in the absorption spectra of these compounds.

24. "A new phosphoric ester obtained by the aid of yeast-juice."

(Preliminary note.) By Arthur Harden and Robert Robison.

In the preparation of hexosediphosphoric acid from lævulose and disodium hydrogen phosphate a second phosphoric acid derivative

is also obtained. This is found in the filtrate after the separation of the diphosphate by treatment with lead acetate, and is precipitated on the addition of a solution of basic lead acetate. A portion of the new compound is also precipitated along with the lead hexosediphosphate, from which it can be separated by decomposing the salt with hydrogen sulphide, reprecipitating with lead acetate, and repeating these operations several times.

By decomposing the basic lead salt with hydrogen sulphide an aqueous solution of the acid itself may be prepared. It gives Seliwanoff's reaction, reduces Fehling's solution, and yields an osazone. It is strongly dextrorotatory, the specific rotation being very much higher than that of hexosediphosphoric acid. When the solution is boiled phosphoric acid is liberated and the rotatory power falls, whilst the reducing power is slightly increased.

The barium salt was obtained by neutralising the solution of the acid with baryta, filtering, and adding an equal volume of alcohol, whereupon the salt was precipitated as a white, amorphous solid. It is readily soluble in both hot and cold water, differing in this respect markedly from barium hexosediphosphate. Various methods of purification have been employed, but the salt has not yet been obtained entirely free from nitrogenous impurities. The results of analyses, however, approximate fairly closely to those required for the barium salt of a hexosemonophosphoric acid, $C_6H_{11}O_6 \cdot PO_3Ba$.

A similar compound is also obtained when dextrose is substituted for lævulose, but it has not yet been ascertained whether these two compounds are or are not identical. The investigation is being continued, and the relations of this substance to hexosediphosphoric acid and to the process of alcoholic fermentation are being studied.

ADDITIONS TO THE LIBRARY

I. *Donations.*

Dumas, Jean Baptiste, Stas, Jean Servais, and Boussingault, Jean Baptiste Joseph Dieudonné. L'air, l'acide carbonique, et l'eau. (Les Classiques de la Science, Vol. I.) Paris 1913. pp. xii + 104. ill. 1 Fr. 30. (*Recd.* 16/12/13.) From the Publisher: Armand Colin

Foucault, Léon. Mesure de la vitesse de la lumière. Étude optique des surfaces. (Les Classiques de la Science, Vol. II.) Paris 1913. pp. xii + 122. ill. 1 Fr. 30. (*Recd.* 16/12/13.)

From the Publisher: Armand Colin.

Gay-Lussac, *Louis Joseph*, Avogadro, *Amedeo*, Ampère, *André Marie*, Dumas, *Jean Baptiste*, Gaudin, *Antoine*, and Gerhardt, *Charles Frédéric*. Molécules, atomes, et notations chimiques. (Les Classiques de la Science, Vol. IV.) Paris 1913. pp. xiv+116. ill. 1 Fr. 30. (Recd. 16/12/13.)

From the Publisher : Armand Colin.

Redwood, *Sir Boverton*. Petroleum : A treatise on the geographical distribution and geological occurrence of petroleum and natural gas ; the physical and chemical properties, production, and refining of petroleum and ozokerite ; the characters and uses, testing, transport, and storage of petroleum products ; and the legislative enactments relating thereto ; together with a description of the shale oil and allied industries ; and a full bibliography. 3rd edition. 3 vols. London 1913. pp. xxxii + 367, 417, 382. ill. 50s. net. (Recd. 9/12/13.)

From the Author.

Thénard, *Louis Jacques*, Schönbein, *Christian Friedrich*, Marignac, *Jean Charles Galissard de*, Soret, *Jacques Louis*, Troost, *Louis Joseph*, Hautefeuille, *Paul*, and Chappuis, *James*. Eau oxygénée, et ozone. (Les Classiques de la Science, Vol. III.) Paris 1913. pp. xii + 111. ill. 1 Fr. 20. (Recd. 16/12/13.)

From the Publisher : Armand Colin.

II. By Purchase.

Classen, *Alexander*, and Cloeren, *H*. Quantitative analysis by electrolysis. Translated from the 5th German edition by *William T. Hall*. New York 1913. pp. xiv+308. ill. \$2.50 net. (Recd. 10/12/13.)

Georgievics, *George von*. Lehrbuch der chemischen Technologie der Gespinnstfasern. I. Lehrbuch der Farbenchemie. 4th edition, edited by *Eugène Grandmougin*. Leipzig 1913. pp. xiv + 570. M. 15.—. (Recd. 10/12/13.)

Partington, *James Riddick*. A text-book of thermodynamics. With special reference to chemistry. London 1913. pp. x+544. 14s. net. (Recd. 10/12/13.)

Sabatier, *Paul*. La catalyse en chimie organique. Paris 1913. pp. xiv + 255. 10 Fr. (Recd. 16/12/13.)

Wilson, *H. Maclean*, and Calvert, *H. T*. Trade waste waters : their nature and disposal. London 1913. pp. xii + 340. ill. 18s. net. (Recd. 10/12/13.)

At the next Ordinary Scientific Meeting, on Thursday, February, 5th, 1914, at 8.30 p.m., the following papers will be communicated:

"The absorption spectra of the vapours and solutions of various substances containing two benzene nuclei." By J. E. Purvis.

"The oxidation of some benzyl compounds of sulphur. Part II. Benzyl tetrasulphoxide." By J. A. Smythe.

"The reaction between iodine and aliphatic aldehydes." By H. M. Dawson and J. Marshall.

"The erosion of lead." By J. F. Liverseege and A. W. Knapp.

"Acylation as influenced by steric hindrance: the action of acid anhydrides on 3:5-dinitro-*p*-aminophenol." By R. Meldola and W. F. Hollely.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30

No. 424.

Thursday, February 5th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society, through death, of:

	Elected.	Died.
Frank Baker.....	Feb. 21st, 1907.	Jan. 21st, 1914.
Frederick George Richards.....	Feb. 15th, 1905	Jan. 21st, 1914.

Certificates were read for the first time in favour of Messrs.:

Abdel Hameed Ahmad, B.Sc., The University, Edgbaston, Birmingham.

Charles Wesley Bayley, 63, Caxton Road, Wood Green, N.

Robert Barclay Craig, 50, North Albion Street, Glasgow.

Jaroslav Heyrovský, B.Sc., 24, Agincourt Road, N.W.

Lawson John Hudleston, B.Sc., 68, Parliament Hill, Hampstead, N.W.

Arthur Ulysses Newton, B.Sc., 37, Netherhall Gardens, Hampstead, N.W.

Lall Behary Seal, Third Assistant Chemical Examiner, Rangoon, Burma.

Norman Cecil White, B.A., B.Sc., 35, Spencer Park, Wandsworth, S.W.

Of the following papers, those marked * were read:

***25. "Existence of racemic compounds in the liquid state."**

By Clarence Smith.

The investigation, by the Ramsay-Shields' method, of the existence of racemic compounds in the liquid state (Mitchell and Smith, T., 1913, 103, 489) has been extended to include substances which contain a hydroxyl group. Not infrequently such substances are associated in the liquid state. The dissociation produced by rise of temperature is manifested by an abnormally large rate of decrease of the molecular surface energy, so that the value of k increases with rise of temperature, and does not remain constant (or decrease slightly), as is the case with unassociated liquids. If, therefore, the optically active modifications of a liquid are associated and the inactive form is an equal molecular mixture of the active forms, the expectation is legitimate that the k values of all the modifications will increase at the same rate with rise of temperature, whereas if the inactive form is a racemic compound (associated or not), material differences will be observed in the k values of the inactive and the active liquids. Unfortunately, all the liquids, the active forms of which are at present at the author's command, have proved to be unassociated between 0° and 90°, so that the preceding method of proof is unavailable. However, the practically constant and not materially different k values of the active and the inactive modifications of each of the substances examined prove, as in the case of the pinenes and the limonenes (*loc. cit.*), that the inactive modifications are not liquid racemates.

The following values of k (mean of four values between 10° and 80°) have been calculated: methyl- β -phenylethylcarbinol, *dl*-form 2.185, *d*-form 2.015, *l*-form 2.15; methylhexylcarbinol, *dl*-form 2.045, *d*-form 1.975, *l*-form 1.91; phenylethylcarbinol, *dl*-form 2.02, *l*-form 1.96; methyl β -hydroxy- β -phenylpropionate, *dl*-form 2.33, *d*-form 2.395.

DISCUSSION.

Dr. DUNSTAN pointed out that Mr. Thole had already shown that the inactive carbinols prepared by Dr. Pickard were *dl*-mixtures and not racemic compounds. He further stated that, even when racemic compounds had been found to exist in solution, the quantity present in equilibrium with the active components was always very small.

***26. "The water gas equilibrium in hydrocarbon flames."**

By George William Andrew.

The author has examined the equilibrium conditions as regards the reversible system $\text{CO} + \text{OH}_2 \rightleftharpoons \text{CO}_2 + \text{H}_2$ in hydrocarbon flames

by exploding at varying initial pressures homogeneous mixtures of such hydrocarbons as methane, ethane, and ethylene with quantities of oxygen insufficient for complete combustion, but sufficient to prevent any deposition of carbon on explosion (for example, $\text{CH}_4 + \text{O}_2$, $2\text{CH}_4 + 3\text{O}_2$, $2\text{C}_2\text{H}_6 + 3\text{O}_2$, $2\text{C}_2\text{H}_6 + 5\text{O}_2$, $\text{C}_2\text{H}_4 + 2\text{O}_2$, etc.).

The results prove that, notwithstanding the very different maximum flame temperatures in the various experiments, the equilibrium ratios $\frac{\text{CO} \times \text{OH}_2}{\text{CO}_2 \times \text{H}_2}$ in the cooled products were nearly

constant throughout the series, and practically identical with the value found by H. B. Dixon in his well-known experiments on the division of oxygen between CO and H_2 in flames, thus:

Mixture.	Mean " K " = $\frac{\text{CO} \times \text{OH}_2}{\text{CO}_2 \times \text{H}_2}$.
$\text{CH}_4 + \text{O}_2$	3.98
$2\text{CH}_4 + 3\text{O}_2$	3.98
$2\text{C}_2\text{H}_6 + 3\text{O}_2$	4.12
$2\text{C}_2\text{H}_6 + 5\text{O}_2$	3.63
$2\text{C}_2\text{H}_4 + 3\text{O}_2$	3.43
Mean...	3.83

It would thus appear that the experimentally determined equilibrium constant " K " does not correspond with the maximum flame temperature, but with some lower temperature in the "cooling curve" when the gases cease to react rapidly. This temperature is identified as lying somewhere between 1500° and 1600° . It was further shown that so rapidly does the equilibrium in the system $\text{CO} + \text{OH}_2 \rightleftharpoons \text{CO}_2 + \text{H}_2$ adjust itself to the falling temperature, during the cooling period down to the said temperature, that even the deposition of carbon or the recurrence of considerable quantities of methane in the products has little or no influence on the said equilibrium.

27. "The absorption spectra of the vapours and solutions of various substances containing two benzene nuclei." By John Edward Purvis.

The observations prove that all the various vapour bands of benzene are obliterated in such compounds as diphenyl, diphenylmethane, diphenylamine, diphenyl ether, etc., and all the various vapour bands of aniline in such compounds as azobenzene, azoxybenzene, benzidine, etc. In every instance the vapour bands and the solution bands are similar.

28. "The oxidation of some benzyl compounds of sulphur.
Part II. Benzyl tetrasulphoxide." By John Armstrong
Smythe.

When benzyl tetrasulphide is oxidised with hydrogen peroxide, benzyl tetrasulphoxide is formed in quantitative yield. Benzyl trisulphide, on oxidation, gives the same compound, in addition to benzaldehyde, sulphuric acid, and benzyldisulphonic acid.

Benzyl tetrasulphoxide is a somewhat unstable compound, melting at 134—139° and decomposing at its melting point into benzyl disulphide and sulphur dioxide. When heated in solution, or treated with a variety of reagents, it decomposes into benzyl disulphoxide, sulphur, and sulphur dioxide, and the subsequent reaction of these products gives the clue to a number of changes which the compound undergoes.

Excess of hydrogen peroxide oxidises the tetrasulphoxide to sulphuric and benzyldisulphonic acids; some benzaldehyde is also formed, as is the case with all the polysulphidic compounds of benzyl on oxidation.

Other reactions, which serve to bring out the relationship of the tetrasulphoxide with other sulphur compounds, were described.

29. "The reaction between iodine and aliphatic aldehydes."
By Harry Medforth Dawson and Joseph Marshall.

According to Chautard (*Ann. Chim. Phys.*, 1889, [vi], 16, 145), iodine reacts with the aliphatic aldehydes in alcoholic solution in the presence of iodic acid, and monoiodo-substitution products are formed. In some cases the substances obtained are supposed to be α -derivatives, whilst in others it is claimed that β -substitution products are produced. In view of the fact that evidence has been obtained that halogen substitution in the aldehydes is preceded by isomeric change, and that β -substitution products cannot be accounted for, if this is the mechanism of the reaction, it was considered advisable to repeat some of Chautard's experiments.

The authors find that there is no evidence of the formation of β -iodopropaldehyde, the properties of the substance obtained being in entire agreement with the supposition that it is the α -iodo-derivative.

The statement that alkyl esters are formed when the iodoaldehydes are acted on by silver acetate is also not confirmed by the authors' observations. In the case of iodoacetaldehyde, no trace of ethyl acetate was found, and the product appears to be acetyl-glycollaldehyde.

30. "The erosion of lead."

By John Francis Liverseege and Arthur William Knapp.

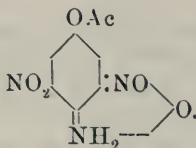
The authors have examined the action of a slightly alkaline natural water on strips of sheet lead under the conditions of the test proposed by Houston (area of 6.45 sq. cm. of lead exposed to 10 c.c. of water in a test-tube), save that a duration of one day was preferred to the seven or fourteen days suggested by Houston. It was found that erosion was due to the action of oxygen in the presence of water. Carbon dioxide in an amount up to 1 per cent. by volume produced little effect on the amount of erosion; when 2 or more per cent. of carbon dioxide was present, erosion no longer occurred, for the liquid remained clear, and lead was dissolved (in amount less than that removed by erosion). The amount and kind of erosion was chiefly dependent on the alkalinity of the water. With alkalinity expressed as parts of calcium carbonate per 100,000 of water, (a) lime giving 3—9 parts of alkalinity reduced the erosion, but larger and smaller quantities slightly increased it; (b) calcium carbonate giving 4 parts of alkalinity greatly reduced erosion; (c) calcium carbonate giving only 2 parts of alkalinity practically prevented it. Variations in the amount of organic matter did not influence the erosion. Exposure to glass lowered the erosive quality of the water, but filtration through sand did not.

The amount of lead eroded was less the greater the distance from the lead to the water surface, and was generally proportional to the area of the surface of the lead exposed, and independent of the volume of the water.

31. "Acylation as influenced by steric hindrance: the action of acid anhydrides on 3:5-dinitro-*p*-aminophenol." By Raphael Meldola and William Francis Hollely.

The known *N*-acetyl derivative of the above dinitroaminophenol is best prepared by starting from the diacetyl derivative and hydrolysing the latter by cold dilute sodium hydroxide solution. The authors find that this dinitro-*p*-aminophenol has the remarkable property of becoming acylated at the hydroxyl group with extreme facility, the *O*-acetyl derivative being formed by simply boiling the dinitro-compound with a little acetic anhydride diluted with acetic acid for half-an-hour or less. In these circumstances the amino-group is unattacked, and the isomeric *N*-acetyl and *O*-acetyl derivatives can accordingly be prepared by regulating the conditions. The authors attribute this property to the extreme

protection of the amino-group by the ortho-nitro-groups, aided probably by an ortho-quinonoid structure due to the existence of an "inner salt" structure:



Reasons were given, based chiefly on the marked difference in colour between the isomerides and the character of their absorption spectra (photographed by Dr. J. T. Hewitt), for assigning the above formula to the *O*-acetyl derivative. The authors conclude that all the nitro-derivatives of the aminophenols in which there is a nitro-group adjacent to an amino-group are best represented as "inner salts" of the above type.

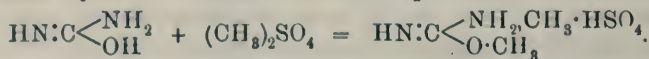
32. "The constitution of carbamide. Part I. The preparation of *isocarbamides* by the action of methyl sulphate on carbamides." By Emil Alphonse Werner.

It was pointed out that hitherto carbamide has not been known to yield by any direct reaction derivatives of the type



in contrast to thiocarbamide, which readily affords the sulphur analogues HN:C(SR)·NH_2 by the direct reaction with the alkyl haloids. So far, *isocarbamides* of the types HN:C(OR)·NH_2 , RN:C(OR)NH_2 , and RN:C(OR)·NHR have been obtained by the union of cyanamides and alcohols in the presence of hydrogen chloride or sodium ethoxide (Stieglitz and McKee, *Ber.*, 1900, **33**, 1518; and Bruce, *J. Amer. Chem. Soc.*, 1904, **26**, 419, 449).

It was shown that methyl*isocarbamide* and its substituted derivatives may be readily prepared from carbamide and substituted carbamides by the aid of methyl sulphate; the change takes place quantitatively in accordance with the equation:



Whilst in the case of carbamide the reaction is liable to become very violent unless the temperature is carefully controlled, the change proceeds quite smoothly with the substituted derivatives. The free bases may be isolated by treating the product with sodium hydroxide solution, and extracting with ether or alcohol.

The decomposition of methyl*isocarbamide* methyl hydrogen sulphate, and the substituted derivatives has been examined, and the results have furnished interesting confirmatory evidence in

support of the author's views regarding the constitution of carbamide and substituted carbamides; thus, whilst the methylisocarbamide salt and the derivatives of the types $\text{HN:C} \begin{smallmatrix} \text{NR}_2 \\ \text{O} \cdot \text{CH}_3 \end{smallmatrix}$ and $\text{HN:C} \begin{smallmatrix} \text{N} \cdot \text{R}'' \\ \text{O} \cdot \text{CH}_3 \end{smallmatrix}$ afforded cyanuric acid and mono-*N*-methylcyanuric acid as part of the decomposition products, neither of these acids was obtained from the derivatives of the type $\text{RN:C} \begin{smallmatrix} \text{NH}_2 \\ \text{O} \cdot \text{CH}_3 \end{smallmatrix}$ prepared from the mono-substituted carbamides.

The interaction of carbamide and methyl sulphate carried on slowly to the stage of the decomposition of the isocarbamide salt may be used as a quick and simple method for the preparation of pure methylamine. If the reaction is allowed to become very violent some dimethylamine is formed.

33. "A new formula for the latent heat of vapours."

By Malcolm Percival Applebey and David Leonard Chapman.

A new formula for the heat of vaporisation of liquids, of which a preliminary account has already been published (P., 1913, 29, 24) was deduced from the thermodynamic principles and van der Waals' equation. The latent heats of the vapour of some common non-associated and associated compounds were calculated with the aid of the formula, and the values obtained were compared with those experimentally determined by S. Young (*Sci. Proc. Roy. Dubl. Soc.*, 1910, 12, 414).

34. "The electro-deposition of zinc at high current densities."

By John Norman Pring and Uryln Clifton Tainton.

At certain very high-current densities the electro-deposition of zinc can be effected in presence of a high concentration of free acid. Under these conditions the ratio of zinc to hydrogen liberated actually increases with the acid concentration up to a certain value, and also increases with the current density. In this way, with a concentration of sulphuric acid of about 15 grams per 100 c.c. and a current density of between 20 and 50 amperes per sq. dcm. the metal can be deposited with an efficiency of about 95 per cent.

With lead anodes this electrolysis is achieved with a potential difference about 5 volts and with zinc anodes 3 volts.

The presence of small quantities of colloidal matter exerts a marked effect on this reaction, and enables the production of bright,

adherent deposits. The presence of the colloid also enables the application of a higher current density, and in this way raises the current efficiency.

In these solutions a very strong retardation was observed in the deposition of iron present in the electrolyte. On account of this, considerable quantities of this metal in the electrolyte caused very little contamination of the zinc.

The results obtained could not be entirely ascribed to effects of over-voltage, or surface tension, or viscosity of the electrolyte, and are probably mainly determined by influences which control the rate of the reactions involved in the change from the ionised to the free element.

Thet results obtained in this work indicate the most favourable conditions under which zinc can be obtained from commercial solutions, either with a view to the recovery of the metal or to its application for the purpose of electro-plating.

35. "The ageing of alloys of silver and tin."

By William Arthur Knight.

The author has investigated the ageing of filings of alloys of silver and tin, and the densities of unaged and aged filings of the alloy Ag_3Sn . The ageing of filings of the alloy Ag_3Sn is not accompanied by a detectable change of weight, and this applies whether the ageing is carried out in coal gas or in air. Ozone and hydrogen peroxide did not oxidise these filings at room temperature, and, further, after treatment with these oxidising agents, the filings were still unaged. From these experiments, in conjunction with others previously published, the hypothesis that the ageing of these filings is due to superficial oxidation was shown to be untenable. It was found that hydrogen sulphide at room temperature had no effect on the state of ageing of the filings. The phenomenon of ageing becomes less pronounced when the content of silver in the alloy exceeds 75 atoms per cent., solid solutions of silver in the compound Ag_3Sn thus having the same effect as the free tin in those alloys which contain less than 75 atoms per cent. of silver. Density determinations showed that the density of aged filings of the alloy Ag_3Sn is greater than that of unaged filings; thus, as there is no increase in weight, there must be a contraction in volume on ageing. Dilatometer measurements confirmed this contraction, although the results did not agree accurately with those deduced from density determinations.

36. "The action of phosphorus pentachloride on the esters of glyceric acid; optically active $\alpha\beta$ -dichloropropionates." By Percy Faraday Frankland and Andrew Turnbull.

From lævorotatory methyl, ethyl, *isobutyl*, and heptyl glycerate respectively the authors have obtained the corresponding $\alpha\beta$ -dichloropropionates, of which the methyl compound was dextro- and the others lævo-rotatory. The dextrorotation of methyl $\alpha\beta$ -dichloropropionate increases with rise of temperature, whilst the lævorotation of the others diminishes in the same circumstances. There would appear, therefore, to be no doubt that all of these dichloropropionates have the same configuration.

A more highly chlorinated inactive compound was in each case also obtained, having the molecular formula $C_3H_2Cl_5OR$, of which the probable constitution is $CH_2Cl \cdot CCl_2 \cdot CCl_2 \cdot OR$ or



in which R stands for methyl, ethyl, *isobutyl*, and heptyl respectively (see also T., 1913, 103, 718).

37. "A criticism of Holmes' method of determining the molecular complexity of liquids." By William Ernest Stephen Turner.

In a recent paper (T., 1913, 103, 2147), and in continuation of previous work (T., 1906, 89, 781; Holmes and Sageman, *ibid.*, 1907, 91, 1608; 1909, 95, 1919), Holmes sets out the results of a method which he employs for the determination of the molecular complexity in the liquid state. As a new method of attacking an old problem it deserves a welcome, but the results are so much different from those deduced on the basis of other and well-known methods that they call for examination.

The view adopted by the author of the theory is that in most cases the only forces which are brought into action when two liquids mix are of a physical character, and that the miscibility of liquids depends on the true relative molecular volumes, or what comes to the same thing, the relative radii, of the constituents. The method employed to obtain the relative complexities is, therefore, to determine the molecular composition, referred to the gaseous state, of the liquid mixture in which the maximum deviation occurs between the calculated and observed proportions by volume of the constituent with the larger molecular volume. The ratio of the molecular proportions so obtained is considered as that of the relative molecular complexities, water, for example, from its mixture with ethyl tartrate being considered to have a molecule, $(H_2O)_4$, relative to the ester; and by similar processes, molecular

formulae $(C_4H_{10}O)_4$, $(CHCl_3)_8$, $(C_6H_6)_8$, $(C_6H_{14})_8$, and $(CS_2)_{16}$ are assigned. In practice, however, the method is not so simple as it appears; thus, the mixtures of maximum deviation in the case of water with ethyl and propyl alcohols are $C_2H_5O, 1\frac{1}{4}H_2O$ and $C_3H_7O, 1\frac{1}{2}H_2O$ respectively, and of water and *n*-butyric acid, $4C_4H_8O_2, 7H_2O$; yet the alcohols and butyric acid are nevertheless held to be of a similar complexity to water in order to agree with the author's theory that molecular radii must have certain values to permit of miscibility. Nor are substances of approximately equal molecular volume, like aniline and ethyl acetate, soluble in water to anything like the same extent, and to explain this discrepancy, speculations are introduced concerning the quasi-electrical forces which are presumed to act, causing disturbances in the molecular volume or co-volume.

Without dealing further with these speculations, however, it may be said that the results themselves are sufficient evidence of the antagonism between this method and those based on current physico-chemical doctrines. The main points to be noted about the values of the degree of complexity given by Holmes are that (1) they appear to vary from substance to substance by the factor 2, being 1, 2, 4, 8, or 16; (2) they are represented by integral numbers; (3) the substances which all other methods demonstrate to be normal are often the most associated of all.

Now the occurrence of whole numbers as association factors must have a definite meaning. In a gas the molecules of which are capable of association there is at any temperature a condition of equilibrium between two sets, the more and the less complex molecules, this equilibrium being readjusted at each alteration of temperature. With sulphur vapour, according to the conditions of temperature and pressure, molecules S_8 , S_6 , S_2 , and S_1 exist, three forms often co-existing (Preuner and Schupp, *Zeitsch. physikal. Chem.*, 1909, **68**, 129). There is no a priori reason to suppose that in the liquid state an associated substance can have but one degree of complexity independent of temperature; indeed, it would be surprising if the general effect of temperature and pressure was entirely different for different states of matter. The case of nitrogen peroxide may be quoted against such a possibility; for as liquid nitrogen peroxide becomes coloured with rise of temperature, it must of necessity indicate that a different molecule is being produced, almost certainly NO_2 , since the substance of this formula has a brown colour in the state of vapour; thus, without any assumption either as to the distribution of kinetic energy added to a substance, or of the actual molecular complexity, the behaviour of nitrogen peroxide clearly shows that the degree of

aggregation of a liquid is certainly affected by temperature variation. If Holmes' theory is correct, however, then it is most improbable that temperature has such an effect. Holmes himself admits this (T., 1913, **103**, 2164), for if the degree of complexity can be represented as a whole number in every one of the twenty-seven examples given, then it is highly improbable that either of the constituents of a liquid can have present within it molecules of two or more degrees of complexity, such as one must presume to exist on the consideration of the non-integral values derived by the Ramsay and Shields' method and its numerous modifications, or Traube's or Guye's or any other method depending on the study of properties very varied in character; and the improbability is all the greater when it is remembered that Holmes' numbers are derived from measurements made at purely arbitrary temperatures at which the liquids are far from being at corresponding states.

Again, the degree of complexity deduced by the method appears to be independent of the nature of the second component of the mixture, for the value arrived at is the same; for example, when ethyl alcohol is mixed with water, or with ethyl ether, methyl iodide, or carbon disulphide, results wholly at variance from those obtained by freezing-point and boiling-point measurements, which indicate that the nature of the solvent is a powerful factor in modifying molecular state (compare Auwers, *Zeitsch. physikal. Chem.*, 1899, **30**, 300; Meldrum and Turner, T., 1908, **93**, 876; 1910, **97**, 1605; Turner, *ibid.*, 1911, **99**, 880).

The third point mentioned above is equally important. Against the probability that *n*-hexane, benzene, and carbon disulphide are associated in the way Holmes believes, there is much evidence from a consideration of several properties. It would, for example, not be easy to reconcile the great complexity of $(CS_2)_{16}$, of molecular weight 1216, with a boiling point as low as 46°. There are, however, more fundamental objections. Consider the substances ethyl ether, ethyl acetate, benzene, *n*-hexane, chloroform, and carbon disulphide, all of which Holmes considers so complex. In the state of vapour they each occupy a volume corresponding with the simplest possible molecular formula, and if, therefore, any alteration of complexity occurs, it must be presumed to take place when the vapour condenses. If, therefore, the temperature of the mixture of liquid and vapour be raised towards the critical point, either the molecular complexity of the liquid must decrease (which on Holmes' view is improbable, as shown above) or that of the vapour must increase, since liquid and vapour become identical at the critical point. Now when vapour and liquid are of different degrees of complexity, it has been found (Young, *Phil. Mag.*, 1892,

[v], **34**, 503; Young and Thomas, T., 1893, **63**, 1191; Young, "Stoichiometry," Longmans, 1908; compare Ramsay, *Proc. Roy. Soc.*, 1894, **56**, 171) that the various critical relationships are abnormal. Water, the alcohols and acetic acid, all of which Holmes agrees are associated, are abnormal; but benzene, *n*-hexane, ether, ethyl acetate, and alkyl iodides are not, and one may conclude that the complexity of the liquid and vapour undergoes little or no change. Similarly, it is possible from the value of the surface tension of a liquid at the ordinary temperature (Ramsay and Shields, T., 1893, **63**, 1089) or from the viscosity (Batschinski, *Zeitsch. physikal. Chem.*, 1911, **75**, 665) to calculate with a fair degree of accuracy the critical temperatures of benzene, ether, ethyl iodide, ethyl acetate, and carbon disulphide, whereas with the unquestionably associated substances this is quite an impossible matter.

In conclusion, it may be pointed out that Holmes' results are deduced from solutions, and not from the pure liquid itself, in which case, despite the strength of solution used, there should be at least some measure of comparison between his results and those derived from methods based on osmotic-pressure determination. Actually, results of an opposite character are found, hydrocarbons and their halogen derivatives, ethyl acetate, carbon disulphide, etc., to which Holmes assigns a high degree of complexity, being quite unassociated by freezing-point and similar tests. It therefore follows from what has been said, that if Holmes' method is correct, temperature has no effect on the degree of complexity of a liquid; and present interpretations of critical data, as also van't Hoff's laws of solution, are untenable. If, on the other hand, they are correct, Holmes' deductions cannot be. In the author's opinion, Holmes' numbers cannot represent the molecular complexities of liquids, either actual or relative.

38. "Phytin and phytic acid." By George Clarke.

A detailed description of work of which a preliminary account has already appeared (*P.*, 1913, **29**, 27).

39. "Sulphonyl and carbonyl derivatives of alanine. Resolution of externally compensated *p*-toluenesulphonylalanine into its optically active components." (Preliminary note.) By Charles Stanley Gibson.

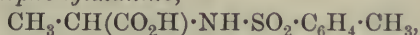
In continuation of the work of Pope and Gibson (*T.*, 1912, **101**, 339), a comprehensive stereochemical study of derivatives of alanine and other amino-acids is being undertaken.

The method of preparation of externally-compensated *p*-toluene-

sulphonylalanine has been conveniently modified, and the compound has been resolved into its optically active components by the method of Pope and Gibson (*loc. cit.*).

One equivalent of *p*-toluenesulphonylalanine was treated in boiling aqueous solution with half an equivalent each of strychnine and sodium hydroxide, and after allowing the clear solution to remain, an almost theoretical quantity of the strychnine salt of *d*-*p*-toluenesulphonylalanine separated. This was recrystallised from very dilute alcohol, and obtained in clusters of colourless needles, melting at 188–189°. The acid remaining in the mother liquor from the separation of the strychnine salt was then isolated, and treated with the corresponding quantities of brucine and sodium hydroxide in boiling water. After some time a good quantity of the brucine salt of *l*-*p*-toluenesulphonylalanine separated. This was recrystallised from a large quantity of boiling water, and obtained in long, colourless prisms, melting at 148–149°.

d-*p*-Toluenesulphonylalanine,



was obtained in the usual manner from the strychnine salt, and after one recrystallisation from aqueous alcohol it was found to be pure, and separated in long, colourless needles, melting at 131–132°. Its rotation was determined in alcoholic solution at 25°:

0.5894, made up to 25 c.c. and observed in a 2-dcm. tube, gave $\alpha_D + 0.37^\circ$, $[\alpha]_D + 7.71^\circ$.

In a similar way *l*-*p*-toluenesulphonylalanine was isolated from the brucine salt, and this was obtained pure after two recrystallisations from aqueous alcohol. It separated in well-defined, colourless crystals, melting at 131–132°. The melting point of the racemic compound is 138–139° (*loc. cit.*). The rotation of the *laevo*-compound was determined under the same conditions as the above:

0.5472 gave $\alpha_D - 0.35^\circ$, $[\alpha]_D - 7.62^\circ$.

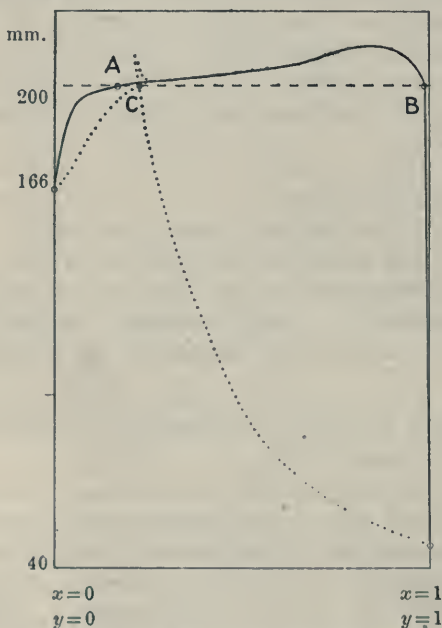
The completion of this and other investigations is being delayed so that the final observations may be made under better and more accurate conditions.

40. "The 'azeotropic' mixtures of ethyl acetate and water."

By Robert Tabor Lattey.

Although its derivation signifies "unchanged by boiling," Wade defined an azeotropic mixture as one of maximum (or minimum) boiling point. The mixtures of ethyl acetate and water described by Merriman (T., 1913, 103, 1798) do not strictly fall under this

definition. The points representing their composition and pressure on a P/x diagram are three—two for liquid phases and one for vapour phase. None of these is a maximum point; that representing the vapour phase is the intersection of two curves. This was pointed out in the case of triethylamine and water, where similar conditions prevail (T., 1907, 91, 1959). It is not possible to construct the complete P/y curve (y =molecular fraction of water in vapour) from Merriman's data, but its correct form at 37.55° is shown in the accompanying figure. The right-hand branch cannot have the form assigned to it by Merriman, since $p_2=yP$ by defini-



Vapour pressures of ethyl acetate and water at 37.55° .

tion and p_2 is very nearly constant for the water-vapour in contact with its solutions in ethyl acetate at each of the temperatures investigated.

For a true azeotrope, $\frac{dP}{dy}=0$. In the case of ethyl acetate and water, $\frac{dP}{dy}$ has two values for the vapour in contact with mutually saturated solutions. At 37.55° these are given by the two values of $\frac{y-x}{y(1-y)}P$, namely, $\frac{0.231-0.169}{0.231 \times 0.769}P$ and $\frac{0.231-0.986}{0.231 \times 0.769}P = +70$ and -850 , using Merriman's data.

There is a hypothetical azeotrope in this case having the composition $x=y=0.25$ (approximately). This cannot be realised, since the liquid separates into two layers. The horizontal line in the figure indicates the composition at A and B of the saturated liquid phases, and at C of Merriman's so-called "azeotrope." Liquid and vapour cannot co-exist under conditions indicated by points above the line ACB . For, suppose a solution were prepared having $x >$ that corresponding with the point A , for example, $x=0.18$, the vapour corresponding with this liquid would have a composition between $y=0.23$ and $y=0.25$, and exert a pressure of about 205 mm. Such a vapour is saturated at about 194 mm., and would, therefore, undergo partial condensation. Distillation would therefore go on until two liquids, A and B , had formed.

The second (hypothetical) maximum at about $x=0.85$ does not indicate an azeotrope. It is true that $\frac{dP}{dx}$, $\frac{dp}{dx}$, and $\frac{dp_2}{dx}$ are all zero. It is, however, not necessary that $\frac{dP}{dx}$ shall also be zero, and hence $y = x \cdot \frac{dP}{dy}$ does not change signs here, since both dP and dy change signs. If the following forms of the equation deduced by Duhem, Margules, and Lehfeldt are examined:

$$\frac{dP}{dy} = \frac{y-xP}{y(1-y)} \quad \text{and} \quad \frac{dp_2}{dy} = \frac{1-x}{1-y}P \quad \text{and} \quad \frac{dp_1}{dy} = -\frac{x}{y}P,$$

it is seen that (i) if $y=x$ the total and partial pressure curves all have maxima or minima, that is, an azeotrope is formed; (ii) it does not follow that because $\frac{dP}{dx} = 0$, either $\frac{dP}{dy} = 0$ or $y = x$.

On page 1799 (*loc. cit.*) Marshall's equation has been misinterpreted: x represents the composition of the liquid. As Merriman points out, x has two values (corresponding with the two layers) in the case considered, and neither of these is the same as y for the vapour. Marshall's equation is another way of writing $y=x$ when $\frac{dP}{dy} = 0$, and since, as has been shown above, this condition is not fulfilled, the equation is not applicable. The calculation carried out by Merriman is simply an application of Dalton's law of partial pressures.

41. "Direct combination of nitrous acid with primary, secondary, and tertiary amines." By Pañchañan Neogi.

Having isolated the nitrites of the primary, secondary, and tertiary amines from mixtures of their hydrochlorides and alkali

nitrites (Neogi, P., 1911, **27**, 242; T., 1912, **101**, 1610; *Chem. News*, 1913, **108**, 53, 62), the author advanced the theory that an amine nitrate is formed as an intermediate compound in the interaction of nitrous acid and the amines (excepting purely aromatic amines). In continuation of the same subject, the direct action of free nitrous acid and free amine at a low temperature has been studied. It has been found that with suitable precautions pure amine nitrites are obtained by the combination of ice-cold solutions of free nitrous acid with the amines. In this way, ammonium, methylammonium, diethylammonium, trimethylammonium, benzylammonium, and piperidinium nitrites have been obtained.

42. "The mechanism of nitrification." (Preliminary note.)

By Ernest Moore Mumford.

Investigation was directed to the bacterial oxidation of aqueous solutions of ammonium salts on suitably inoculated experimental filters with a view to identify intermediate products of oxidation and determine the internal mechanism of the change.

The filters were inoculated from actively nitrifying sewage filters, the organism being checked by the customary methods.

As a result of the work, it has been found that the oxidation proceeds in a series of stages compatible with the hypothesis that bacterial oxidation is attained by successive hydroxylation of hydrogen atoms, and subsequent elimination of water.

Intermediate compounds were identified in hydroxylamine salts and salts of hyponitrous and nitrous acids, and it was found that the loss of nitrogen, which invariably takes place to a certain extent on such filters, is due in part to complex interactions between these various intermediate compounds; and, as the relative concentration of these compounds is determined by the degree of aeration of the filter, this hypothesis is in correlation with the observed difference in the loss of nitrogen between a percolating filter and a contact bed.

The hydroxylamine was identified by the sodium nitroprusside reaction, and estimated by titration with iodine solution in presence of sodium hydrogen carbonate, and the hyponitrous acid was detected by the formation of the insoluble silver salt; the nitrous and nitric acids were determined by the customary methods employed in water analysis.

43. " α - and β -Trimethyl cobalticyanide."

By Ernald George Justinian Hartley.

Silver cobalticyanide and methyl iodide react at a temperature of about 45° to form silver iodide and two isomeric trimethyl cobalticyanides, together with some decomposition products. The two isomerides differ both in physical and chemical properties. One of them, which it is proposed to call the α -compound, is less soluble than its isomeride in water and the lower alcohols. It crystallises from hot water in very fine, hair-like fibres somewhat resembling glass-wool.

It forms double salts with silver cobalticyanide and with silver nitrate.

The β -variety crystallises in minute needles from any of the above solvents. It also forms double salts with silver cobalticyanide and silver nitrate respectively, but of different composition from the corresponding α -compounds.

44. "The preparation of dithiobenzoic acid."

By Gerald Noël White.

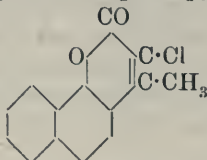
The following simple method of preparing dithiobenzoic acid, $C_6H_5 \cdot CS_2H$, directly from benzaldehyde in one operation has been found to give satisfactory results.

A solution of 18 grams of benzaldehyde in 300 c.c. of alcohol and 150 c.c. of ammonia (D 0.880) is mixed with powdered sulphur (10 grams), and the mixture then saturated with hydrogen sulphide, first at the ordinary temperature, and finally, with frequent shaking, on the water-bath. The treatment with hydrogen sulphide is continued until all the sulphur has dissolved, and on dilution of a sample with water, no appreciable precipitate of benzaldehyde is obtained. The deep red liquid, after being diluted and shaken with benzene to remove a small quantity of unchanged aldehyde, is acidified with hydrochloric acid. The precipitate is collected and washed with ether, which is also employed to extract the dithiobenzoic acid from the acidified liquid. The substance is readily obtained as a purple oil by treating the concentrated ethereal solution with methyl alcohol.

45. "Condensation of ethyl α -chloroacetoacetate with phenols."

By Biman Bihari Dey.

On condensing α -naphthol with ethyl α -chloroacetoacetate under suitable conditions in the presence of concentrated sulphuric acid at 0° , 3-chloro-4-methyl-1:2- α -naphthapyrone,



is obtained in a 70—75 per cent. yield. It crystallises from glacial acetic acid in clusters of hard, colourless needles, melting at 227° . On boiling it for several hours with excess of 30 per cent. alcoholic potassium hydroxide, crystals of the sodium salt of α -naphthacoumarilic acid slowly separate out, which, on acidification, is converted into the free 2-methyl- α -naphthafuran-1-carboxylic acid, prepared by Hantzsch and Pfeiffer (*Ber.*, 1886, **19**, 1303). It melts at 248° , about 6° higher than that given by Hantzsch and Pfeiffer.

m-Cresol condenses with ethyl chloroacetoacetate to give an almost quantitative yield of 3-chloro-4:7-dimethylcoumarin, $C_{11}H_9O_2Cl$, crystallising from alcohol in long needles melting at 135° . On boiling with alcoholic potassium hydroxide, it is converted into 2:5-dimethylcoumarilic acid, melting at 218° ; Fries and Fickewirth (*Annalen*, 1908, **362**, 51), who obtained it from the product of bromination of 4:7-dimethylcoumarin, gave 212° as the melting point.

p-Cresol under similar conditions forms 3-chloro-4:6-dimethylcoumarin, crystallising from acetic acid in colourless needles melting at 160° ; boiling alcoholic potassium hydroxide converts it into 2:4-dimethylcoumarilic acid, prepared by Hantzsch and Lang (*Ber.*, 1886, **19**, 1299).

o-4-Xylenol under the same treatment gives an 80 per cent. yield of 3-chloro-4:6:7-trimethylcoumarin, $C_{11}H_{11}O_2Cl$, crystallising from alcohol in needles melting at 170° . It is converted by alcoholic potassium hydroxide into 2:4:5-trimethylcoumarilic acid, $C_{12}H_{12}O_3$, crystallising from ethyl acetate in colourless needles melting at 249° . On distilling the acid with excess of dry lime, the corresponding trimethylcoumarone, $C_{11}H_{12}O$, passes over as an oil, which solidifies on cooling in ice; it crystallises from acetone in snowy flakes melting at 39 — 40° .

Phloroglucinol gives a good yield of 3-chloro-5:7-dihydroxy-4-methylcoumarin, $C_{10}H_7O_4Cl$, crystallising in yellow needles melting

at 308°. The *dimethyl ether*, $C_{12}H_{11}O_4Cl$, forms aggregates of short needles melting at 170°; the *diacetyl* derivative, $C_{14}H_{11}O_6Cl$, forms needles melting at 154°, and the *dibenzoyl* derivative, $C_{24}H_{15}O_6Cl$, crystallises in rhombic plates melting at 186°.

Hydroxyquinol gives a rather poor yield of 3-chloro-6:7-dihydroxy-4-methylcoumarin, $C_{10}H_7O_4Cl$, crystallising in nearly colourless needles, and melting at 259—260°. The *diacetyl* ($C_{14}H_{11}O_6Cl$) and the *dibenzoyl* ($C_{24}H_{15}O_6Cl$) derivatives melt at 172° and 192° respectively.

46. "The action of phosphoric oxide on dibenzylmalonic acid."

By Hubert Cyril Cutts.

As 1-hydrindone may be prepared by the intramolecular condensation of phenylpropionyl chloride (Kipping T., 1894, **65**, 480), it seemed probable that dibenzylmalonic acid might be converted into a compound of the constitution $C_6H_4 \begin{smallmatrix} <CH_2> \\ <CO- \end{smallmatrix} C \begin{smallmatrix} <CH_2> \\ <CO- \end{smallmatrix} C_6H_4$.

Attempts to bring about this change by means of phosphoric oxide resulted in the isolation of two products, melting at 145° and 78° respectively. The investigation of these compounds and of their derivatives was just on the point of completion (last July) when further experiments were rendered superfluous by the publication of a paper by Leuchs, Wutke, and Gieseler (*Ber.*, 1913, **46**, 2200). The results of these investigators, who, however, employed thionyl chloride, and the facts established by the author, showed that the compound melting at 145° was the *O*-dibenzylacetyl derivative of 1-hydroxy-2-benzylindene, and the compound melting at 78°, dibenzylacetic anhydride.

47. "The relation between the absorption spectra of acids and their salts. Part II." By Robert Wright.

The examination of a number of acids and salts, with reference to their light absorbing power, seems to point to the following conclusions: (1) The absorption spectra of strong acids are identical with those of their sodium salts; (2) Moderately strong acids, such as acetic, etc., are more absorbent than their sodium salts, but the difference between the spectrum of an acid and its salt diminishes with the weaker homologues; (3) Very feeble acids, such as hydrogen sulphide or arsenious acid, are less absorptive than their salts. The generalisations given do not, of course, apply to those cases where the acid and salt are of different structure.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Bayliss, *William Madlock*. The nature of enzyme action. 3rd edition. London 1914. pp. vi+180. 5s. net. (*Recd.* 8/1/14.)

From the Publishers: Messrs. Longmans, Green and Co.

Gerber, *Armand*. Zur Kenntniss des Orthotolidins. Basel 1889. pp. 76. (*Reference.*) From Geh. Rat Prof. Otto N. Witt.

Loeb, *Morris*. The scientific work of Morris Loeb. Edited by Theodore W. Richards. Cambridge 1913. pp. xxiii+349. ill. \$2 net. (*Recd.* 27/1/14.)

From the Publishers: Harvard University Press.

Smiles, *Samuel*. Chemische Konstitution und physikalische Eigenschaften. Translated by P. Krassa and edited by R. O. Herzog. Leipzig 1914. pp. xii+676. M. 21.—. (*Recd.* 2/2/14.)

From the Author.

II. *By Purchase.*

Abderhalden, *Emil*. [Editor.] Biochemisches Handlexikon. Vol. VIII. Berlin 1914. pp. 507. M. 36.50.—. (*Recd.* 11/1/14.)

Allen, *Alfred Henry*. Commercial organic analysis. Vol. VIII. 4th edition. Edited by W. A. Davis and Samuel S. Sadtler. London 1914. pp. x+696. ill. 21s. net. (*Recd.* 2/2/14.)

Kauffmann, *Hugo*. Die Valenzlehre. Stuttgart 1911. pp. ix+558. M. 15.—. (*Recd.* 23/1/14.)

Wiley, *Harvey Washington*. Principles and practice of agricultural analysis. Vol. III. Agricultural products. 2nd edition. Easton, Pa., 1914. pp. xv+846. ill. 26s. net. (*Recd.* 5/2/14.)

At the next Ordinary Scientific Meeting on **Thursday, February 19th, 1914, at 8.30 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Condensations of cyanohydrins. Part II. The condensation of chloralcyanohydrin with chloral hydrate and with bromal hydrate." By H. L. Crowther, H. McCombie, and T. H. Reade.

"The system: ethyl ether-water-potassium iodide-mercuric iodide. Part II. Saturated solutions in the four-component system." By A. C. Dunningham.

"The connexion between the dielectric constant and the solvent power of a liquid." By W. E. S. Turner and C. C. Bissett.

"The viscosities of some binary liquid mixtures containing formamide." By E. W. Merry and W. E. S. Turner.

ERRATUM.

PROCEEDINGS, 1914.

Page 6, line 1, for "**Part XXI.**" read "**Part XXII.**"

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, February 19th, 1914.

Blair, Ethelbert William,

70, Fountayne Road, Stoke Newington, N.

Student. B.Sc. London (2nd Class Hons. Chemistry). Neil Arnott Scholar in Chemistry, 1913. Intend following Chemistry as a profession.

J. T. Hewitt.

Arthur E. Pitt.

Clarence Smith.

R. W. Merriman.

Frank G. Pope.

A. D. Mitchell.

Calvert, Albert Frederick,

“Royston,” Eton Avenue, N.W.

Author of Technical and Statistical books relating to Mining and Chemical Industries. Engaged on new books dealing with “The Chemistry of Salt” and “The Manufacture of Salt,” and am anxious to keep up to date in the latest developments of Chemical Research.

Kenneth S. Low.

E. O. Courtman.

W. H. Merrett.

W. Gowland.

J. C. Philip.

Clifford, Sydney George,

3, Norman Villas, East Dulwich, S.E.

Analytical Chemist. Certificate Dept. of Chemistry, Finsbury Technical College. For a period Junior Assistant to Professor Meldola, and now Chemist with Messrs. Waterlow and Sons, Ltd.

Raphael Meldola.

R. H. Buttle.

Arthur J. Hale.

C. Molville Clark.

Reginald F. Easton.

Dás, Behari Lal,

107/2/1, Manabarpukur Road, Kalighat, Calcutta.

Vaccination Inspector, Health Dept., Calcutta Corporation.

Passed the final examination of the Campbell Medical School, Calcutta ; then I was Student for 3 years in Chemistry. Late Resident Medical Officer, Government Emigration Agency and Burmah Military Police. Reason is to improve in science.

B. B. Dutta.

Dhirendranath Mitra.

M. Sinha.

Kunjo Behary Seal.

J. Chakraborty.

Davenport, Sydney Edward,

"Fernbank," York Road, Windsor.

Analytical Chemist. For three years articled to Mr. Leo Taylor, F.I.C., Public Analyst for the Metropolitan Borough of Hackney. At present chief assistant at Mr. Taylor's Laboratories, 31 Moorgate Street.

Percy Edgerton.

R. P. Hodges.

B. C. Smith.

Charles A. Keane.

G. Francis Morrell.

Davidson, Thomas Alexander,

57, Strathyre Avenue, Norbury, London, S.W.

Works Manager. Analytical and Research Chemist ; Speciality : Shellac, Drying Oils and Varnishes. Lecturer on "Painters' Oils, Colours and Varnishes" at Regent St. Polytechnic. Original work published : "Action of Driers on Linseed Oil," *Proc. Paint and Varnish Society*, Nov., 1908 ; Feb., 1909 ; June, 1910.

Frank E. Weston.

J. Cruickshank Smith.

William Hy. Collier.

Walter F. Reid.

H. Stanley Redgrove.

Davies, Thomas Eynon.

25, Trevor Street, Aberdare, Glam.

Assistant Master, and Lecturer in Mining Chemistry. B.Sc., Hons. in Chemistry ; Post Graduate Diploma in Metallurgy, Univ. of Wales ; Ten years' experience as Science Master ; Lecturer in Mining Chemistry, Glam. County Council. At present engaged in work upon the "Detection and Estimation of Mine Gases," and desire to avail myself of the facilities offered by the Society to carry out this work.

Claude M. Thompson.

William G. Tonner.

E. P. Perman.

T. Campbell James.

A. A. Read.

B. Perrott.

Denington, Richard Charles.

69, Dover Road, S. Wanstead, Essex.

Research Chemist to Messrs. Bastol, Ltd. Trained, East London

Technical College and Royal College of Science. Research Assistant to A. R. Ling, Esq.; Works Chemist, Messrs. A. Boake Roberts; Research Chemist, British Alcohol Syndicate and Bastol, Ltd.

J. T. Hewitt.

Arthur R. Ling.

Frank G. Pope.

Lewis Eynon.

F. W. Brown.

Fernie, Charles George.

"Holmleigh," Northwood, Middlesex.

Science Tutor. B.Sc. (London University). Engaged in advanced work preparatory for proposed research work at the Imperial College of Science.

H. B. Baker.

J. W. Hinchley.

James C. Philip.

C. E. Sladden.

A. T. King.

Finch, George Ingle,

41, Ladbroke Road, W.

Demonstrator in the Department of Chemical Technology, Imperial College of Science and Technology, South Kensington. Obtained the Diploma of the Swiss Federal Polytechnic in March, 1911. April, 1911, to Oct., 1911, Assistant Lecturer in Electro- and Physical Chemistry, and from Oct., 1911, to March, 1912, Assistant in Technical Chemical Analysis and Chemistry at the Swiss Federal Polytechnic. March to September, 1912, studied at the University of Geneva. November, 1912, to Jan. (inclusive), 1913, as Assistant Chemist in the Research Department, Royal Arsenal, Woolwich. I have occupied the present post since Feb., 1913. I have published four papers, viz.: three in the *Zeitschrift für das ges. Schiess- und Sprengstoffwesen*, May, 1910; April, 1912; August, 1912. In the *Chemiker Zeitung*, 1912, page 782.

William A Bone.

P. W. Robertson.

H. Brereton Baker.

Arthur A. Eldridge.

James C. Philip.

A. T. King.

H. V. A. Briscoe.

Furness, Reginald,

90, Woodlands Road, Ansdell, Lytham, Lancs.

Research Chemist to Hydrogenators, Ltd. B.Sc. Victoria, 1912. Mercer Scholar; Loblane Medallist; Schunck Research Assistant; M.Sc. (Vict.) 1913. 1912—1914, Private Research Assistant to Prof. W. H. Perkin, F.R.S., in the Universities of Manchester and Oxford. Joint author of papers (in the course of writing, to be

published in the *J.C.S.*) with Prof. A. Lapworth and Prof. W. H. Perkin and others.

Harold B. Dixon.

W. H. Perkin.

Arthur Lapworth.

B. Lambert.

F. R. Lankshear.

A. F. Walden.

Garth, John,

170, St. Thomas's Road, Preston.

Physician. Medical Officer of Health, Analyst, and Bacteriologist for Fulwood. Former Student of Dr. Muter, Public Analyst, South London. Former Student of Dr. Campbell Brown, Public Analyst for Lancashire. Former Student of Professor Delépine, Bacteriologist, Victoria University.

John Hargreaves.

John W. Towers.

William Naylor.

Charles Dreyfus.

James Hargreaves.

G. Fitz-Brown.

Francis Henry Tate.

Gibbs, Ivan Richard,

University Hall, 3 Moor's Gardens, Chelsea.

Assistant Demonstrator, Imperial College of Science and Technology. B.A. Oxford, 2nd Class Honours Chemistry.

H. B. Baker.

James C. Philip.

B. Mouat Jones.

A. T. King.

P. W. Robertson.

Hale, James Stanley,

Principe 4, Bilbao, Spain.

Analytical Chemist. Studied chemistry at the Central Technical School, Liverpool, and was assistant to G. Watson Gray, Esq., F.I.C., of Liverpool, for over ten years.

G. Watson Gray.

James Smith.

W. H. Pearson.

C. Durham Garbutt.

John Hanley.

Harper, Theophilus,

39, Camden St., Belfast.

Pharmaceutical Chemist. Lecturer on Pharmacy, Materia Medica, and Botany, Municipal Technical Institute, Belfast. Member of the Pharmaceutical Societies of Great Britain and Ireland; Member of the British Pharmaceutical Conference; formerly Demonstrator of Chemistry, School of Applied Chemistry, Belfast, and Lecturer on General

and Pharm. Chemistry, Schools of Science and Technology, Belfast, and Municipal Technical Institute, Belfast.

Henry Wren.	<i>A. W. Stewart.</i>
John Hawthorne.	<i>A. K. Macbeth.</i>
Ellis Clayton.	<i>C. R. Crymble.</i>
Thomas Maben.	<i>R. Gilmour.</i>
John C. Umney.	<i>A. Percy Hoskins.</i>

C. T. Bennett.

Harrap, Eric Russell,

Maisemore, Ebury Road, Rickmansworth, Herts.

Works Chemist. Two years Assistant to George T. Holloway Esq., Consulting Chemist, etc. (Sept., 1908, to Oct., 1910). Three years Works Chemist to Messrs. Bells United Asbestos Co., Ltd. (Oct., 1910, to Oct., 1913).

George T. Holloway.	Charles A. Keane.
William G. Wagner.	H. Burrows.

J. G. Baxter.

Horwood, Oswald Ryle (Clerk in Holy Orders),

Tunstall Rectory, Suffolk.

Physician and Surgeon. M.A., 2nd Class Science, Corpus Christi College, Cantab.; M.R.C.S., England; L.R.C.P., London. Anderson Prizeman, London Hospital. Chief Master, Keswick Laboratory (Chemical, 1905—1906). 1907—1910, sent out by Board of Education to build Simla Chemical Laboratory. Manufactured reagents, chemicals, etc., for this laboratory, as we found it better to manufacture our own on the spot—we acquired the necessary apparatus. 1910—1912, studied Physiological Organic Chemistry (with a view to medicine and surgery).

W. G. Gledhill.	Harold Rogerson.
Herbert Marsden.	<i>Chas. W. Moore.</i>
E. Herbert Fison.	<i>Frank Tutin.</i>

Iyer, Manappadam Ramaswami Viswanatha,

50, Prem Chand Bural Street, Bow-Bazar, Calcutta.

Assistant Chemist, Indian Tea Association, Indian Museum, Calcutta. Formerly a student of Technical Chemistry in the Victoria Jubilee Technical Institute, Bombay, for three years. At present an Assistant Chemist in the Scientific Department of the Indian Tea Association.

P. H. Carpenter.	Kali Prosonuo Rai.
David Hooper.	<i>Dhirendranath Mitra.</i>

Tin Kari Ghose.

James, Dan Ivor,

"Frondeg," Llandilo, S. Wales.

B.Sc. (Wales), Hons. in Chemistry; M.A. Cantab., 1st Class Nat. Sci. Tripos, Parts I. and II. (Chemistry); Late Lecturer in Chemistry, School of Mines and Technology, Johannesburg; Joint Author, "Racemisation of α -Hydroxy-acids," *J.C.S.*, 1912; "Action of Alkalis on Phenolphthalein," *Journ. Chem. Min. and Met. Soc., S.A.*, 1912.

W. J. Sell.

F. W. Dootson.

H. J. H. Fenton.

J. G. M. Dunlop.

W. J. Pope.

Kolhatker, Gopal Balkrishn,

Ferguson College, Poona, India.

Professor of Chemistry, Ferguson College. M.A. (with Honours) of the Bombay University. A research student in the Indian Institute of Science, Bangalore. At present engaged in determining velocity of alcoholysis with different catalysers by physico-chemical methods.

M. W. Travers.

H. E. Watson.

J. J. Sudborough.

N. S. Rudolf.

D. D. Kanga.

Leigh, Alfred John,

Duff House, Banff, N.B.

Analytical Chemist, at Duff House Sanatorium, Banff. Associate of Royal College of Science, South Kensington (student from 1909-1913). Graduate of London University (B.Sc., 1st Class Hons. Chemistry, 1912—Internal).

Henry F. Harwood.

H. B. Baker.

Chapman Jones.

James C. Philip.

M. O. Forster.

Leighton, Frederic William,

Lydiard Tregoze, Wootton Bassett, Wilts.

Mining Engineer and Metallurgist. Certificate of Manchester University in Applied Chemistry. Diploma of the School of Technology, Manchester. Associate of the School of Technology (Metallurgy).

E. L. Rhead.

F. S. Sinnatt.

E. Knecht.

Jas. Grant.

S. J. Peachey.

Makin, Fredk. Arthur,

"The Nest," Taunton Road, Ashton-under-Lyne.

Manager and Chemist. Engaged as Manager and Chemist to

Messrs. R. F. Barrett & Co., Soda Water Mfrs., having served with them for 25 years. For the past three years have attended the Technological Chemistry Classes in the School of Technology, Manchester. Passed all examinations during that period, and obtained First Class Honours, City and Guilds. Am desirous of becoming a member so as to keep up to date with chemical progress.

Jas. Grant.

F. G. Richards.

F. S. Sinnatt.

E. L. Rhead.

S. J. Peachey.

E. Knecht.

McLaren, Alexander Williamson,

3, Hayfield Tce., Langside, Glasgow.

Analytical Chemist. Assistant to R. R. Tatlock and Thomson, City Analysts of Glasgow for 13 years, and Student at Royal Technical College, Glasgow, for eleven years.

R. R. Tatlock.

Thomas Gray.

R. T. Thomson.

G. G. Henderson.

Harry Dunlop.

Macpherson, Archibald,

51, Keir Street, Glasgow.

Chemist. 15 years' practical experience in Manufacturing and Agricultural Chemistry. Being engaged in scientific work with Messrs. Manley & James, Ltd., Manufacturing Chemists, London, I desire to extend my opportunities for keeping in touch with advancements in scientific chemical science, and to enjoy the privilege of attending the meetings of the Chemical Society, also to receive the Journal.

F. W. Crossley-Holland.

G. Mason Williams.

Carter White.

J. Stuart Lawson.

John Wm. Patterson.

Morris, Thomas,

53, Poolstock, Wigan.

Brewer and Chemist. Engaged for the past twelve years as Brewer and Chemist to Messrs. Airey's Brewery, Ltd., Wigan. During the last three years have attended the Technological Chemistry Classes at the School of Technology, Manchester. Passed all School and the Honours City and Guilds examinations during that period. Am desirous of becoming a member so as to keep up with advances in chemical knowledge.

Jas. Grant.

S. J. Peachey.

F. S. Sinnatt.

F. G. Richards.

E. Knecht.

Nichols, Raymond William,

Central Experimental Farm, Ottawa, Canada.

Assistant for Milling and Baking to the Cerealists of the Dominion of Canada. Assistant in the Scientific Department of Messrs. Guinness's Brewery, Dublin, for 10 years, including 3 years assistant in the Guinness Research Laboratory.

A. J. Banks.

J. H. Millar.

Thomas B. Case.

Horace T. Brown.

Adrian J. Brown.

Odum, William Julian,

Ardmore, Bray, Co. Wicklow.

Flour Milling Chemist. B.A., Trinity College, Dublin. Interested in all Analysis Work and especially that connected with Flour Milling. Studied at Aynsme Technical Laboratories.

J. Stewart Remington.

Sydney Young.

C. Smith.

Wm. C. Ramsden.

Emil A. Werner.

Oldroyd, Rowland Ernest,

90, Park Road, Rochdale.

Chemist (Works). At present Chemist to Messrs. John Bright & Bros.; at present Member of the Committee for the Standardisation of Indigo (Cotton and Wool), Textile Institute. Late Lecturer in Dyeing at Halifax Technical College. Clothworkers' Scholar and Chemistry Prizeman, Yorkshire College.

C. A. Crook.

E. W. Smith.

W. J. Stansfield.

J. H. Dyson.

Reginald B. Brown.

Pickworth, Frederick Alfred,

70, Highfield Road, Dartford.

Pharmaceutical and Analytical Chemist. Assistant Analyst to Messrs. Burroughs Wellcome & Co., Dartford. Major Examination of Pharmaceutical Society. Intermediate B.Sc., Honours in Chemistry (Lond.).

H. A. D. Jowett.

Harold King.

Frederic H. Lees.

W. P. Hayworth.

Frank Lee Pyman.

Francis H. Carr.

Pick, William Henry,

141, Mare Street Hackney, London, N.E.

Science Master, Queen Mary's School, Basingstoke, Hampshire.

B.Sc. (London), 1911. Graduated from University College, London ; London University Teacher's Diploma, 1912. Licentiate and Member, College of Preceptors.

Samuel Smiles.

R. Whytlaw-Gray.

Percy May.

J. N. Collie.

— V. Lefebure.

Riley, Conly Hunter,

Anchorage, Clayton-le-Moors, Accrington.

Chemical Manufacturer. Student of Chemistry in the Blackburn Technical School and the University of Manchester ; member of the firm of James Riley & Co., Chemical Manufacturers, Openshaw, Accrington.

Harold B. Dixon.

F. P. Burt.

Arthur Lapworth.

E. C. Edgar.

F. R. Lankshear.

Ch. Weizmann.

Robson, William Pawson

78, Rolland Street, Cape Town, S. Africa.

Chemist. Honours, B.A., Cape of Good Hope University (1910) ; Assistant Govt. Analyst, Cape Town (1911) ; Ph.D., Halle University, Germany (1913) ; Research Student, University College, London, 1913.

J. Norman Collie.

W. B. Tuck.

Samuel Smiles.

H. T. Clarke.

C. R. Crymble.

Roy, Chandra Bhusan,

Moradpore P.O., Bankipore.

Demonstrator of Chemistry, Patna College. M.A. (Chemistry), Calcutta University ; Demonstrator in Chemistry, Patna College.

P. C. Rây.

Jyoti Bhushan Bhaduri.

K. S. Caldwell.

Hem Ch. D. Gupta.

Jatindranath Sen.

Smith, Joseph de Carl (Junior),

Oak House, Newmarket Road, Norwich.

Student. Bachelor of Science of London University. Proceeding with the study of Chemistry.

Hugh Ramago.

Richard Hornby.

Walter W. Reed.

Frank Clowes.

Thos. Tyrer.

Stamp, Charles Alfred,

Passey's House, Eltham, Kent.

Food and General Analyst, Institute of Hygiene, 34 Devonshire Street, Harley Street, W. 3 Years with Leo Taylor, F.I.C., C.C. Public

Analyst for Hackney ; Assistant Analyst, Messrs. Liebig's & Co., Ltd., Southwark Street, S.E. ; First Assistant at Kent County Laboratories, Maidstone (under late Dr. Adams).

Frank E. Weston.

W. M. Seaber.

C. T. Bennett.

M. S. Salamon.

B. C. Smith.

Stone, Horace Gilbert,

24, High Street, High Wycombe, Bucks.

Schoolmaster [Science Master at Spring Gardens School, High Wycombe]. (1) 3 Years' course of Study at Birkbeck College for the B.Sc. degree of London University ; (2) 2 Years' course at St. Paul's Coll., Cheltenham, for Int. B.Sc. under W. Boone, Esq., B.A. B.Sc. F.C.S. ; (3) A Bachelor of Science of Lond. Univ. ; (4) Science Master at the above school.

Alex. McKenzie.

Geoffrey Martin.

G. W. Clough.

Fred Barrow.

G. H. Martin.

Temple, Harold Edwin,

239, Cashel St., Christchurch, N.Z.

Assistant Engineer to the Christchurch Gas, Coal and Coke Co., Ltd. Certificates: Dept. of Education ; Practical and Theoretical Adv. Inorganic and Organic Chemistry ; Honours in Inorganic. Special courses of study in Examination of Foods, Identification of Poisons and Preparation of Dyes, fine Tar products and Alkaloids. In charge of all Analyses and research for the Windsor Street and Adderley Street Works of B'ham Corp. Gas Dept. from 1899—1905 ; also had control of erection and working of Cyanogen Plant ; Assistant Engineer, Windsor Street Works, Feb., 1905—Oct., 1906 ; Nechells Works, Oct., 1906—April, 1910 ; Assistant Engineer, Christchurch, N.Z., May, 1910 ; Control of anhydrous ammonia manufacture.

Robert English.

W. B. Davidson.

Harold G. Colman.

A. M. Wright.

Douglas F. Twiss.

Turner, Eustace Ebenezer,

5, Queen's Gate Villas, S. Hackney, N.E.

Research Student. Research Student at East London College. B.Sc., London (First Class Honours Chemistry).

J. T. Hewitt.

R. W. Merriman.

Frank G. Pope.

A. D. Mitchell.

Clarence Smith.

Wright, Robert James,

c/o R. Burnett Esq., 336, Pollokshaws Road, Glasgow.

Assistant Science Master, Hillhead High School, Glasgow. M.A. (Glasgow). Is engaged in teaching Chemistry, and is desirous of keeping in touch with current Chemical literature.

G. G. Henderson.

I. M. Heilbron.

F. J. Wilson.

Jas. A. Russell Henderson.

Thomas Gray.

The following Certificate has been authorised by the Council for presentation to ballot under Bye-law 1 (3):

Cohen, Lionel,

Stock Dept. Laboratory, Casino, N.S.W.

Analyst, Stock Branch Dept. of Agriculture. Eleven years Assistant in the Chemical Laboratory, Dept. of Agriculture, N.S.W. Two years in charge of this laboratory (Casino). Reprints of contributions to scientific work dealing with Chemical matters sent to you 2nd August, 1913.

Loxley Meggitt.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30

No. 425

Thursday, February 19th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society through the death of:

	Elected.	Died.
Gustavus Anthony Abrines (Gibraltar)	Dec. 4th, 1890	June 22nd, 1913
Charles Cunningham Connor (Belfast)	Feb. 18th, 1875	Feb. 10th, 1914
Arthur Ellson Davies (Edinburgh)	Feb. 1st, 1866	Feb. 9th, 1914

Certificates were read for the first time in favour of Messrs.:

Arthur Baxter, B.Sc., 360, York Road, Camden Road, N.

Albert Coulthard, B.Sc., Ph.D., 9, Portland Avenue, Stamford Hill, N.

Robinson Percy Foulds, M.Sc., Stanley Villa, Colne.

Arthur Bertram Hobson, M.Sc., 13, Westy Lane, Latchford, Warrington.

James Riddick Partington, B.Sc., The University, Manchester.

Walter Ryley Pratt, B.Sc., 17, Bloomsbury Square, W.C.

Walter William Reeve, B.Sc., 4, Gowlett Road, E. Dulwich, S.E.

Herbert Corner Reynard, B.Sc., West Ewell, Epsom.

Certificates have been authorised by the Council for presentation to ballot under Bye-law I(3) in favour of Messrs.:

Clifford Girdlestone Gill, Cawnpore Sugar Works, Ltd., Cawnpore, India.

Yusuf Ismail Mulla, Alembic Laboratory, Club Road, Mandalay Shore, Burma.

The PRESIDENT announced that the following changes in the Officers and Council were proposed by the Council:

Vice-Presidents to retire.—Dr. G. T. Beilby and Prof. W. Jackson Pope.

Ordinary Members of Council to retire.—Sir Boverton Redwood, Bart., Mr. W. R. Bousfield, Prof. H. Marshall (Deceased), Prof F. G. Donnan.

As President.—Prof. W. H. Perkin.

As Vice-Presidents who have filled the office of President.—Prof. H. E. Armstrong, Prof. A. Crum Brown, Sir William Crookes, Sir James Dewar, Prof. H. B. Dixon, Prof. Percy F. Frankland, Dr. A. G. Vernon Harcourt, Prof. R. Meldola, Dr. H. Müller, Prof. W. Odling, Sir William Ramsay, Prof. J. Emerson Reynolds, The Right Hon. Sir Henry E. Roscoe, Sir Edward Thorpe, and Sir William A. Tilden.

As Treasurer.—Dr. Alexander Scott.

As Hon. Secretaries.—Dr. Samuel Smiles and Prof. J. C. Philip.

As Foreign Secretary.—Prof. Arthur W. Crossley.

As Vice-Presidents.—Prof. H. Brereton Baker, Prof. P. P. Bedson, Dr. Horace T. Brown, Mr. C. T. Heycock, Prof. E. J. Mills, and Prof. G. T. Morgan.

As New Ordinary Members of Council.—The Earl of Berkeley, Dr. R. H. A. Plimmer, Dr. G. Senter, Prof. J. M. Thomson.

Dr. Samuel Rideal, Prof. J. J. Dobbie, and Sir Alexander Pedler were elected Auditors to audit the Society's Accounts.

Messrs. G. Fowles and H. Rogerson were elected Scrutators, and a ballot for the election of Fellows was held. The following were subsequently declared duly elected:

Ethelbert William Blair, B.Sc.

Albert Frederick Calvert.

Sydney George Clifford.

Lionel Cohen.

Behari Lal Dás.

Sydney Edward Davenport.

Thomas Alexander Davidson.

Thomas Eynon Davies, B.Sc.

Richard Charles Denington.

Charles George Fernie, B.Sc.

George Ingle Finch.

Reginald Furness, M.Sc.

John Garth.

Ivan Richard Gibbs, B.A.

James Stanley Hale.

Theophilus Harper.

Eric Russell Harrap.

Oswald Ryle Horwood, M.A., M.R.C.S.
L.R.C.P.

Manappadam Ramaswami Viswanatha
Iyer.

Dan Ivor James, M.A., B.Sc.

Gopal Balkrishn Kolhatker, M.A.

Alfred John Leigh, B.Sc.

Frederic William Leighton.

Alexander Williamson McLaren.

Archibald Macpherson.

Fredk. Arthur Makin.

Thomas Morris.

Raymond William Nichols.

William Julian Odium, B.A.

Rowland Ernest Oldroyd.

Frederick Alfred Pickworth.

William Henry Pick, B.Sc.

Conly Hunter Riley.
 William Pawson Robson, B.A., Ph.D.
 Chandra Blusan Roy, M.A.
 Joseph de Carle Smith (junior), B.Sc.
 Charles Alfred Stamp.

Horace Gilbert Stone, B.Sc.
 Harold Edwin Temple.
 Eustace Ebenezer Turner, B.Sc.
 Robert James Wright, M.A.

Of the following papers, those marked * were read :

***48. "The production of high vacua by means of finely divided copper." By Thomas Ralph Merton.**

It has been found that the vapour pressures of gases absorbed by finely divided copper are so low that the absorption of gases by this substance may be used for the production of high vacua.

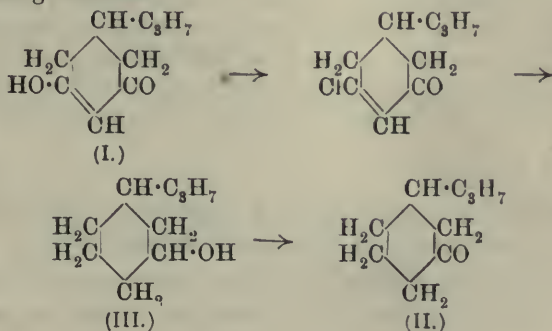
DISCUSSION.

Prof. H. B. BAKER was able to confirm Mr. Merton's results, as, in some work he had done with Prof. Strutt, a tube of copper gauze which had been left with a pressure of 1—2 mm. of nitrogen overnight was found next morning to resist the passage of a very powerful electric discharge. He thought that the method would be of great importance in dealing with small traces of gases.

Dr. LOWRY suggested that the power of absorbing gases was perhaps a function of the amorphous, as contrasted with the crystalline, form of copper. This was in agreement with the fact that this power was lost on heating to 250°, a temperature that was practically identical with the annealing-temperature of hard-drawn copper wire; further, that repeated heating at lower temperatures produced the same effect.

***49. "Hydroaromatic ketones. Part III. 1-isoPropylcyclohexan-3-one." By Arthur William Crossley and Walter Ryley Pratt.**

1-isoPropylcyclohexan-3-one (II) has been prepared from 1-isopropyldihydroresorcin (I) by a series of reactions indicated by the following formulæ :



It boils at 208° , gives a *semicarbazone* melting at 187° , and a liquid *oxime*, the *benzoyl* derivative of which melts at $91-92^{\circ}$.

1-*isopropylcyclohexan-3-ol* (III) is a viscid liquid, boiling at $114^{\circ}/28$ mm., and possessing a characteristic pungent odour. The *o*-nitrobenzoyl derivative crystallises in small, white prisms, melting at $47-48^{\circ}$. Both the alcohol and the ketone give β -isopropyladipic acid on oxidation with potassium permanganate.

It is intended to make the ketone the starting-point in the synthesis of certain meta-terpene derivatives, as it has been found possible by varying the original conditions (T., 1902, **81**, 676) to improve the yield of isopropyl dihydroresorcin so that it may now be obtained in about 70 per cent. of the theoretical amount.

***50. "The spitting of silver." By Herbert Brereton Baker.**

The amount of oxygen absorbed by melted silver is so large that it seems difficult to explain on the hypothesis of a mere solution of such a gas in such a liquid. It seemed conceivable that there might be formed an oxide of silver which was stable at high temperatures, but decomposed on allowing the temperature to fall; a case analogous to the well-known behaviour of silicon trichloride. An attempt has been made to apply a test for the presence in the molten metal of an oxide of silver. It is found that if silver oxide is dropped into melted boron trioxide silver borate is formed, although the temperature is much above the decomposition point of the silver oxide. Accordingly, some highly purified silver was melted in a stream of oxygen, a part only of the surface of the metal being covered with boron trioxide. This procedure was rendered easy by the convexity of the surface of the liquid metal, a ring of the trioxide surrounding the exposed surface. In these circumstances silver borate is formed in large quantity. If, however, the metal is covered entirely, even by a thin film of the trioxide, no silver borate is produced. It cannot be claimed that an absolute proof of the existence of an oxide of silver has been obtained, because there is the possibility of the reaction of three substances together, no two of which will otherwise unite. It seemed worth while, however, to put the experiments on record.

***51. "The rate of transformation of ammonium cyanate in absolute alcohol." By John David McBeath Ross.**

The experiments of Walker and Kay (T., 1897, **71**, 489) on the velocity of the transformation of ammonium cyanate into carbamide

in aqueous alcohol have been extended to solutions containing more than 90 per cent. of alcohol. On the assumption that the action primarily takes place between the ammonium ions and the cyanate ions, it is found that the acceleration previously observed continues up to alcohol of 99.94 per cent. by volume, the increase in the speed of the transformation being most noticeable in solutions containing a large percentage of alcohol. The same conclusions hold good when the action is considered to be primarily due to the non-ionised ammonium cyanate, although in this case the change in the velocity-coefficient is smaller than on the other assumption.

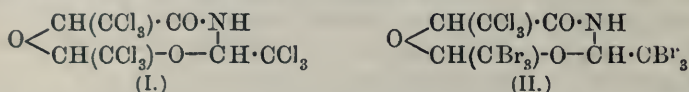
DISCUSSION.

Dr. SENTER referred to the contention of E. E. Walker (*Proc. Roy. Soc.*, 1912, *A*, **57**, 539) that in determining the influence of alcohol on the rate of decomposition of carbamide in aqueous solution, the solutions should not be made up to a definite volume, but the ratio of carbamide to water should be kept constant and varying proportions of alcohol added. Apart from the objections urged by the author of the present paper, the latter method of making up solutions was open to criticism on kinetic grounds. Comparing two solutions in which the ratio carbamide: water was the same, but one of which contained alcohol in addition, the total volume of the latter was considerably greater, and therefore the number of collisions between the reacting molecules or ions, and consequently the rate of reaction differed in the two cases on spacial grounds, apart altogether from other effects. For this reason the usual method of making up to a constant volume, although not free from objection, would appear to afford a much truer representation of the effect of alcohol on the reaction than the method advocated by E. E. Walker.

52. "Condensations of cyanohydrins. Part II. The condensation of chloralcyanohydrin with chloral hydrate and with bromal hydrate." By Horace Leslie Crowther, Hamilton McCombie, and Thomas Harold Reade.

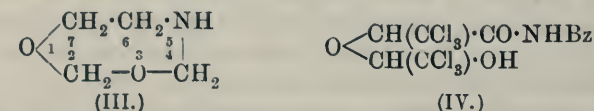
The compound described by Wallach (*Annalen*, 1874, **173**, 297) and Cech (*Ber.*, 1876, **9**, 1020) as being formed by the action of potassium cyanide on excess of chloral hydrate has been shown by the authors to have the constitution (I). In this reaction it is produced by the condensation of normal chloralcyanohydrin (which is first formed) with two molecules of chloral hydrate. This condensation has been shown to take place in the presence of potassium hydroxide. Further, using the same condensing medium, the

authors have been able to condense chloralcyanohydrin with bromal hydrate with the production of compound II:



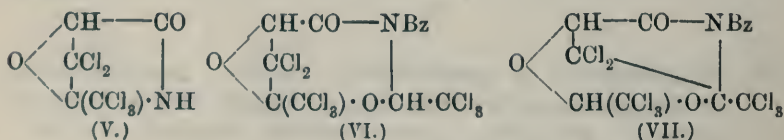
It has been decided to call the parent seven-membered ring (III) 1:3:5-dioxazseptan, so that (I) is called 6-keto-2:4:6-tri(trichloromethyl)-1:3:5-dioxazseptan.

The dioxazseptan derivatives give rise to monoacyl derivatives, in which the acyl group is attached to the nitrogen atom. The benzoyl derivatives when treated with hydrochloric acid, in glacial acetic acid, are decomposed, one chloral (or bromal) residue is eliminated from the molecule, and there results, in the case of the benzoyl derivative of (I), β -trichloro- α -(β' -trichloro- α' -hydroxyethoxy)-propionobenzamide (IV):



This compound, on treatment with sodium carbonate, or hydroxide, yields 4:4-dichloro-3:5-oxido-5-trichloromethyl-2-pyrrolidone (V), a compound which is readily soluble in alkalis, but is precipitated unchanged on the addition of acids. An analogous compound can be prepared from the benzoyl derivative of II.

Another interesting change which is undergone by the benzoyl derivatives is brought about by the action of dilute potassium hydroxide. In this case one molecule of hydrogen chloride is eliminated, and the resulting compound has the constitution VI or VII:



53. "The system: ethyl ether-water-potassium iodide-mercuric iodide. Part II. Solutions saturated with respect to solid phases in the four-component system." By Alfred Charles Dunningham.

The equilibria are represented by means of a tetrahedron, of which a diagrammatic projection was shown. Saturation surfaces exist for the solid phases: potassium iodide, potassium mercuri-

iodide, potassium mercuri-iodide hydrate ($\text{KHgI}_3 \cdot \text{H}_2\text{O}$), and mercuric iodide. The surfaces are divided by binodal curves into homogeneous and heterogeneous areas, on which liquid mixtures, in equilibrium with the solid phase, exist as one or two layers respectively.

In the case of potassium iodide and potassium mercuri-iodide, the homogeneous portions of the saturation surfaces are entirely separated by a heterogeneous area. This corresponds with the fact that in contact with either of these phases, water and ether are only miscible to a very limited extent.

In the case of potassium mercuri-iodide hydrate and mercuric iodide, the saturation surfaces are divided into homogeneous and heterogeneous portions by critical curves. The homogeneous portions thus formed extend almost across the tetrahedron, corresponding with the fact that in contact with these phases water and ether can become miscible in almost all proportions.

54. "The connexion between the dielectric constant and the solvent power of a liquid." By William Ernest Stephen Turner and Crellyn Colgrave Bissett.

In a series of investigations on the factors affecting the solubility of electrolytes, Walden (*Zeitsch. physikal. Chem.*, 1906, **55**, 683) drew the conclusion that a parallelism exists between dielectric constant and solvent power, and later (*ibid.*, 1908, **61**, 633) formulated an expression, $\epsilon/\mu = \text{constant}$, applicable to tetraethylammonium and tetrapropylammonium iodides dissolved in a number of solvents, ϵ representing the dielectric constant of the solvent, and μ the molecular percentage solubility of the solute.

It was now shown that this expression is not generally valid, and does not apply to the solubility data of Peddle and Turner (T., 1913, **103**, 1202) or of Turner and Bissett (T., 1913, **103**, 1904), and on investigation with additional solvents it does not apply, as Walden considered it did, to tetrapropylammonium iodide. An attempt to find another equation was unsuccessful, and it was pointed out that the order of solvent action is in many cases not the order in which the dielectric constants run. Solvent action depends both on the nature of the solute and on that of the solvent.

It was further shown that the solvent action of a number of liquids on *p*-nitrobenzyl chloride and trimethylamine, as measured by Halban (*Zeitsch. physikal. Chem.*, 1913, **84**, 129), and on carbon dioxide and nitrogen (Just, *Zeitsch. physikal. Chem.*, 1901, **37**, 342), is not connected with their dielectric constants.

55. "The viscosities of some binary liquid mixtures containing formamide." By Ernest Wyndham Merry and William Ernest Stephen Turner.

The viscosities of mixtures of formamide with water, methyl and ethyl alcohols, formic, acetic, propionic, and *n*-butyric acids have been determined at temperatures of 25° and 40°. From the results of the investigation it was concluded that: (1) Formamide and the lower alcohols give viscosity curves differing little from the straight line, but as the series is ascended, the calculated and observed viscosities differ by a value which is at first negative and later becomes positive, until, with *iso*amyl alcohol, a curve is obtained which contains a maximum point. The experimental values in the last case were drawn from those of Drucker and Kassel (*Zeitsch. physikal. Chem.*, 1911, **76**, 367).

(2) Formamide and the aliphatic acids give viscosity curves resembling in general character those obtained with aqueous solutions of these acids, there being no maximum point with formic acid, although the calculated values are less than the observed. In the other cases, maximum points were obtained on the curve.

(3) Maximum points on viscosity curves are not always due to the formation of compounds, and that, in consequence, viscosity measurements do not form a trustworthy method of testing for the formation of compounds in solution.

(4) With a series of associated, similarly constituted liquids, each mixed with a common, associated liquid, the observed viscosity departs more and more from the calculated value as the molecular weight increases in the series.

56. "The conversion of *d*-glucosamine into *d*-mannose."

By James Colquhoun Irvine and Alexander Hynd.

A detailed account of an investigation, the results of which have already been communicated in the form of a preliminary note (P., 1913, **29**, 306).

57. "The catalytic activity of acids in ethyl-alcoholic solution."

By Harry Medforth Dawson and Frank Powis.

Measurements of the rate of isomeric change of acetone under the catalytic influence of acids have been made in ethyl-alcoholic solution. From similar experiments in aqueous solution (T., 1913, **103**, 2135) it was previously found that the catalytic effect of the

acid can be represented as the sum of effects produced by the ionised and non-ionised acids. The data for alcoholic solutions also indicate that the "hydrogen ion" is not the only active component, but that the non-ionised acid is also possessed of considerable catalytic power.

It was shown that the observations in aqueous solution afford no information as to the real nature of the ionic catalyst, but that some light is thrown on this question by a comparison of the phenomena of catalysis in water and alcohol. If a comparison is made between aqueous and alcoholic solutions of acids according to their electrical conductivity, in which the acids are ionised to about the same extent, it is found that the speed of the catalysed reaction in alcohol is many hundred times greater than in water. This is explained by the assumption that the active ionic catalyst is the free hydrogen ion which is present in very small concentration in aqueous solutions of acids, but in relatively much greater concentration in alcoholic solution. The retarding influence of small quantities of water on the velocity of this and other reactions in alcoholic solution is in agreement with this hypothesis.

58. "Heats of evaporation; association in liquids and mixtures of liquids." By James Riddick Partington.

The equation of Bakker for the latent heat of evaporation of a liquid, which is deduced from the characteristic equation of van der Waals, gives results in poor agreement with experiment. It was shown that the characteristic equation of D. Berthelot leads to an equation giving results in much closer agreement with the experimental numbers. The equation is:

$$\lambda = \frac{27}{64} R^2 \frac{T_k^3}{p_k v_1 T_1} + R T_1,$$

where λ is the molecular heat of evaporation at the temperature T_1 ; v_1 is the molecular volume of the liquid; p_k , T_k are the critical pressure and temperature, and R is the gas-constant.

Some thermal properties of liquid mixtures were considered from the point of view of thermodynamics.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Thursday, March 26th, 1914, at 4.30 p.m., when the President will deliver his address, entitled "Recent Researches on Tautomerism."

The next Ordinary Scientific Meeting will be held on **Thursday**, March **5th**, 1914, at **8.30** p.m., when the following papers will be communicated:

"A redetermination of the atomic weight of vanadium." By H. V. A. Briscoe and H. F. V. Little.

"The isomerism of the oximes. Part III. The hydroxy-benzaldoximes." By O. L. Brady and F. P. Dunn.

"The constituents of the leaves and stems of *Daviesia latifolia*." By F. B. Power and A. H. Salway.

"The composition of some mediæval wax seals." By J. J. Dobbie and J. J. Fox.

"Experiments on the rate of nitrification." By R. M. Beesley.

"Studies on the constitution of soap solution. The alkalinity and degree of hydrolysis of soap solutions." By J. W. McBain and H. E. Martin.

"The influence of configuration on the condensation reactions of polyhydroxy-compounds. Part I. The constitution of mannitol triacetone." By J. C. Irvine and B. M. Paterson.

"The formation of ethers from mannitol. An example of steric hindrance." By J. C. Irvine and B. M. Paterson.

"The relative strengths of ammonium and the substituted ammonium hydroxides, as measured by their action on a pseudo-base. Part I." By C. K. Tinkler.

"The interaction between nitric acid and brucine in the presence of metallic nitrates." By E. H. Rennie and A. E. Dawkins.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30

No. 426.

Thursday, March 5th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Messrs. E. E. Turner, John K. Wood, A. Bramley, Bertram Campbell, and Ivan R. Gibbs were formally admitted Fellows of the Chemical Society.

The names of the Fellows recommended by the Council for election as official and ordinary Members of Council, 1914-1915, were read from the Chair.

The PRESIDENT announced that the Rooms of the Society will be open for an informal meeting of the Fellows on Thursday, April 30th, from 8 to 10 p.m. Smoking will be permitted, and light refreshments will be provided. Fellows are invited to exhibit apparatus and specimens of interest, and to show experiments, and those wishing to do so are requested to communicate with the Honorary Secretaries not later than the Monday previous to the meeting.

It was also stated that a meeting of the Faraday Society will be held in the Rooms of the Chemical Society on Friday, March 27th, 1914, when a general discussion on "Optical Rotatory Power" will take place. Fellows of the Chemical Society are invited to attend. The meeting will be held from 5 to 6.30 p.m.

and from 8 to 9.30 p.m., tea being served at 4.30. Further particulars can be obtained from the Secretary of the Faraday Society, 82, Victoria Street, S.W.

Certificates were read for the first time in favour of Messrs.:

Raymond Foss Bacon, B.Sc., Ph.D., Mellon Institute of Industrial Research, University, Pittsburg, Pa., U.S.A.

Robert Reginald Baxter, B.A., St. John's College, Oxford.

Brojendranath Ghosh, M.Sc., 59, Hereford Road, Bayswater, W.

Richard Selwyn Haskew, Cwmbran, Newport, Mon.

Ralph Waldo Emerson MacIvor, 47, Victoria Street, Westminster, S.W.

Henry Ratcliffe, 38, Sefton Terrace, Beeston Hill, Leeds.

John Rogers, 195, West George Street, Glasgow.

Percy Charles Rundell, Glenthorne, St. Albans Crescent, Woodford Green.

Max Herbert Tagg, B.Sc., Brentor, Clayton Avenue, Wembley.

Albert Watkins Maggs Wintle, Holly House, Saltcoats, Ayrshire.

Of the following papers, those marked * were read:

***59. "The atomic weight of vanadium."**

By Henry Vincent Aird Briscoe and Harry Frank Victor Little.

The ratios $\text{VOCl}_3 : 3\text{Ag}$ and $\text{VOCl}_3 : 3\text{AgCl}$ have been redetermined. Vanadyl trichloride was decomposed by aqueous ammonia, acidified with nitric acid, and the chloride either titrated against silver according to the method of Richards and Wells (*J. Amer. Chem. Soc.*, 1905, **27**, 459), using a modified nephelometer to determine the end-point, or precipitated as silver chloride and weighed. A new type of apparatus, designed for fractional distillation in a vacuum with the complete exclusion of moisture, was used for the distillation of the vanadyl trichloride and its collection in glass bulbs, and the trichloride was weighed in a manner which obviated the necessity for collecting fragments of broken bulbs.

The results obtained are as follows ($\text{Ag} = 107.88$; $\text{Cl} = 35.457$):

9 expts: $\text{VOCl}_3 : 3\text{Ag} = 0.53554 \pm 0.000008$, whence $V = 50.950$.

2 expts.: $\text{VOCl}_3 : 3\text{AgCl} = 0.40307$, whence $V = 50.952$.

For a number of reasons these results may be slightly too low, and the rounded-off value $V = 50.96$ is preferred. This result is in very close agreement with that deduced by McAdam (*ibid.*, 1910, **32**, 1603) from measurements of the ratio $\text{NaVO}_3 : \text{NaCl}$.

DISCUSSION.

In reply to the President, Mr. LITTLE stated that part of the oxide of vanadium which formed the starting material had been formerly used by Sir Henry Roscoe in his researches on vanadium. A small amount of arsenic present in another portion of the oxide was incidentally eliminated when converting the oxide into vanadyl trichloride, but otherwise no initial purification of the oxide was attempted. The vanadyl trichloride, however, was fractionated until a preparation was obtained quite free from phosphorus and arsenic, and having a constant boiling point (127°). The subsequent fractionation of this product was effected in a vacuum, and no further boiling-point observations were made.

***60. "The isomerism of the oximes. Part III. The hydroxybenzaldoximes." By Oscar Lisle Brady and Frederick Percy Dunn.**

The authors have investigated the hydroxybenzaldoximes, but have failed to obtain stereoisomerides or any confirmation of the existence of the supposed isomeric *m*-hydroxybenzaldoxime described by Jowett (T., 1902, **81**, 707). Dollfus (*Ber.*, 1892, **25**, 1924) assumed that in the monoacetyl derivatives of these oximes the oximino-group was acetylated, but the authors have been able to show that in the case of *p*-hydroxybenzaldoxime it is the phenolic hydroxyl that is acetylated, and not the oximino-group, the compound thus being *p*-acetoxybenzaldoxime. This and the parent hydroxy-oxime have been proved to possess the *anti*-configuration, and the stereoisomeric *p*-acetoxybenzsynaldoxime has been prepared.

In the case of the acetyl derivative of salicylaldoxime, however, it has been shown that the oximino-group is acetylated.

DISCUSSION.

Dr. PYMAN pointed out that Dr. Jowett laid no claim to the discovery of a stereoisomeric *m*-hydroxybenzaldoxime. The oxime had been prepared from *m*-hydroxybenzaldehyde amongst half-a-dozen other derivatives for the purpose of identification, and the discrepancy of melting point was noted, but not fully investigated.

In reply to the President, Mr. BRADY stated that it would probably be difficult to obtain stereoisomeric oximes from 4:5-methylene-*o*-tolualdehyde on account of the methyl group being in the ortho-position with respect to the oximino-group; with reference to the methoxybenzaldoximes, the two isomeric

p-methoxybenzaldoximes had been obtained, but the ortho-compound existed only in one form; the meta-compound had not been investigated.

In reply to Dr. Pyman, he said that there was no wish on the part of the authors to suggest that Dr. Jowett claimed to have obtained an isomeric *m*-hydroxybenzaldoxime; they were, however, of the opinion that it was impossible to obtain a compound melting at 138° by recrystallising *m*-hydroxybenzaldoxime from benzene.

***61. "The constituents of the leaves and stems of *Daviesia latifolia*."
By Frederick Belding Power and Arthur Henry Salway.**

Daviesia latifolia, R. Br. (Nat. Ord. *Leguminosae*), is a shrub indigenous to Victoria, Australia, where, on account of the bitter taste of the leaves, it is known as the "Native Hop Bush."

An examination of freshly collected material, consisting of the leaves and stems of the above-mentioned plant, has shown that its bitterness is due to a crystalline benzoyl derivative of a new disaccharide, the latter (*glucoxylose*) yielding on hydrolysis 1 molecule of dextrose and 1 molecule of xylose. The bitter compound possesses the empirical formula $C_{25}H_{28}O_{12} \cdot H_2O$, melts at 147—148°, and has been designated *dibenzoylglucoxylose*.

Besides a small amount of an aromatic essential oil, the following additional constituents of the plant have been isolated or identified: benzoic, salicylic, *p*-coumaric, and fumaric acids, and a mixture of fatty acids, consisting of palmitic, stearic, and linolic acids; a quercetin glucoside, $C_{27}H_{30}O_{16}$, which is probably identical with rutin; myricyl alcohol; hentriacontane; a phytosterol, $C_{27}H_{46}O$; and a sugar which yielded *d*-phenylglucosazone (m. p. 210°). The resinous material, from which some of the above-mentioned substances were obtained, amounted to about 8.6 per cent. of the weight of drug employed.

DISCUSSION.

Dr. Power, in reply to a question by the President, stated that the recent chemical examination of hops had revealed the presence of no substance similar in character to the bitter principle of *Daviesia* leaves. It was also noted that no botanical relationship exists between the leguminous shrub, *Daviesia latifolia*, R. Br., and the common hop plant, *Humulus Lupulus*, L.

In reply to a question by Mr. Baker, it was explained that the new disaccharide, *glucoxylose*, had only been directly isolated in

the form of its crystalline benzoyl derivative, *dibenzoylglucoxylose*. The amount of the latter compound present in the leaves appeared to be somewhat less than 1 per cent.

***62. "The composition of some mediæval wax seals."**

By James Johnston Dobbie and John Jacob Fox.

An account was given of the examination of the composition of a number of mediæval seals, ranging in date from the thirteenth to the beginning of the sixteenth century.

The seals were found to consist of beeswax alone, or of beeswax mixed with resin in various proportions. The resin could not be identified except in two cases, in which it gave the reactions for colophony.

The red seals were coloured with vermilion, the green with verdigris, the brown and black with verdigris and organic matter.

The beeswax which formed the sole constituent of an impression of the Great Seal of 1350 was practically unaltered in chemical and physical properties, except as regards its power of absorbing iodine, which was slightly less than that which beeswax usually exhibits.

63. "Experiments on the rate of nitrification."

By Richard Moore Beesley.

Solutions of nitrogenous substances were inoculated with a mixed culture of nitrifying and hydrolytic organisms, which were obtained from a secondary contact bed, and the nitrification was allowed to proceed under strictly comparative conditions, with the object of determining the comparative rate of nitrification.

The following substances were employed: carbamide, thio-carbamide, uric acid, aspāragine, glycine, acetamide, methylamine sulphate, aniline sulphate, ammonium oxalate, and ammonium sulphate. The solutions, with which were incorporated suitable mineral media, were made of such a strength as to contain 100 milligrams of nitrogen per 500 c.c.

The course of the nitrification was followed through by means of periodic determinations of the ammoniacal, nitrous, and nitric nitrogen figures. Under these conditions it was found that the various substances nitrified at approximately the same rate, with the exception of thiocarbamide and aniline sulphate, which completely failed to nitrify. Evidence has also been obtained to the effect that in the bacterial oxidation of nitrogen, compounds intermediate between ammonia and nitrous acid are formed.

64. "Studies of the constitution of soap solutions. The alkalinity and degree of hydrolysis of soap solutions." By James William McBain and Herbert Ernest Martin.

From electromotive force determinations, the dissociation product of water at 90° is calculated to be 69.7×10^{-14} ; this result is chiefly of interest in discussing the high real temperature-coefficient of the hydrogen electrode, which is ignored by recent convention.

The hydrolysis and true alkalinity of soap solutions has been quantitatively determined for the first time. In concentrated solutions hydrolysis amounts to only a fraction of a per cent., and even in $0.01N$ -sodium or potassium palmitate it only amounts to 6.6 per cent., and thus the high conductivity of soap solutions is definitely shown not to be due to free alkali. The novel suggestion was advanced that it may be due to highly charged aggregates or micelles exhibiting even an equivalent conductivity comparable with that of ordinary ions (see McBain, *Trans. Faraday Soc.*, 1913, **9**, 99; *Kolloid. Zeitsch.*, 1913, **12**, 256). This suggestion, if confirmed, may apply to such diverse cases as protein salts, dyes, and certain non-aqueous solutions.

In the presence of even one equivalent of free palmitic acid soap solutions are still appreciably alkaline. On the other hand, the alkalinity of solutions containing an excess of alkali is practically that of the added alkali. There is thus no measurable sorption or formation of basic soap in the presence of $0.1N$ -alkali.

Sodium chloride at first decreases, but in larger amounts again increases, the alkalinity of soaps, in accordance with the suggested rule that any influence tending towards coagulation increases the alkalinity of these solutions.

65. "The influence of configuration on the condensation reactions of polyhydroxy-compounds. Part I. The constitution of mannitoltriacetone." By James Colquhoun Irvine and Bina Mary Paterson.

Mannitoltriacetone has been selected as a test substance in an endeavour to correlate the configuration of polyhydroxy-compounds with their capacity to enter into condensation with aldehydes or ketones. It was found that, when dissolved in aqueous alcohol containing minute quantities of hydrogen chloride, the ketonic residues could be removed from mannitoltriacetone in the definite stages indicated below:

Mannitoltriacetone \rightarrow mannitoldiacetone \rightarrow

mannitolmonoacetone \rightarrow mannitol.

Mannitoldiacetone crystallises in needles melting at 37—39°, and has $[\alpha]_D + 15.75^\circ$ in alcohol; on methylation it was converted into *dimethylmannitoldiacetone* (b. p. 140—141°/13 mm., $[\alpha]_D + 21.9^\circ$), which, on hydrolysis, gave *dimethylmannitol* (needles, m. p. 93°, $[\alpha]_D - 8.85^\circ$). This compound, on oxidation with nitric acid, was converted into *dimethylmannonic acid*, which was isolated in the form of the corresponding *lactone* (m. p. 112—114°).

In a parallel series of reactions, *mannitolmonoacetone* (needles, m. p. 85°, $[\alpha]_D$ in alcohol $+ 23.2^\circ$) was converted into *tetramethylmannitolmonoacetone* (b. p. 138—140°/11 mm., $[\alpha]_D + 32.2^\circ$), from which *tetramethylmannitol* was obtained. The compound boiled at 167—169°/13 mm., showed $[\alpha]_D - 12.54^\circ$ in alcohol, and gave, on oxidation with nitric acid, a *tetramethylmannonic acid* (b. p. 180—182°/12 mm.) incapable of forming a lactone.

It was also found necessary to examine the form of tetramethylmannitol obtained by the reduction of tetramethylmannose. The compound thus produced boiled at 177°/11 mm., and showed $[\alpha]_D + 39.8^\circ$ in alcoholic solution, and is thus isomeric with the product obtained by the hydrolysis of tetramethylmannitolmonoacetone. Moreover, on oxidising tetramethylmannose by means of bromine, a second form of *tetramethylmannonic acid* was isolated, which was readily transformed into *tetramethylmannonolactone* (b. p. 174°/11 mm., $[\alpha]_D + 78.8^\circ \rightarrow 38.5^\circ$ in aqueous alcohol).

From these results, the following conclusions are drawn: (1) in mannitoltriacetone the ketonic residues are symmetrically linked to α -carbon atoms; (2) the stabilities of the three residues are unequal; (3) the least stable residue is linked to a primary alcoholic group; (4) the most stable residue is linked to the remaining primary alcohol group.

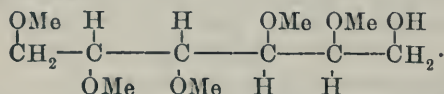
66. "The formation of ethers from mannitol. An example of steric hindrance." By James Colquhoun Irvine and Bina Mary Paterson.

In attempting to prepare mixed ethers by the alkylation of dimethyl- or tetramethylmannitol, it was found that the reaction was completely arrested at a stage when a penta-substituted derivative was formed. Thus, 3:4:5:6-tetramethylmannitol, when subjected to the action of silver oxide and ethyl iodide, was converted into the corresponding *tetramethylethylmannitol* (b. p. 140°/8 mm.), and, in a parallel reaction in which methyl iodide was used, the product consisted of *pentamethylmannitol* (b. p. 137—138°/8 mm.). As the latter compound was converted, on oxidation with nitric acid, into a *pentamethylmannonic acid*

(b. p. $110^{\circ}/0.18$ mm.), the resistance to methylation was evidently presented by one of the terminal hydroxyl groups.

Notwithstanding the configuration symmetry of mannitol, the remaining primary alcohol group behaved in a different manner, and was readily methylated.

The combined results of the research support the view, expressed in the preceding communication, that the terminal alcohol groups in mannitol preferentially assume fixed positions, with the result that three adjacent hydroxyl groups are arranged on the same side of the carbon chain. Only two of these three groups undergo methylation, and the stereochemical formula of pentamethylmannitol is as follows:



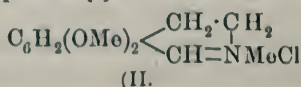
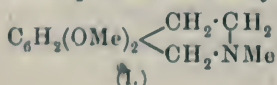
As the silver oxide method of methylation has frequently been employed to discriminate between different types of sugar derivatives, it was necessary to apply the process to 2:3:5:6-tetramethylmannitol in order to ascertain if the secondary alcohol group resisted substitution. The reaction yielded the pentamethylmannitol described above, so that the previous conclusions regarding constitution in the sugar group, which are based on the methylation process, are not affected adversely by the results of the present investigation.

The specific rotations of the partially methylated mannitols now described display a number of regularities from which it is possible to allocate a qualitative rotatory power to each of the four asymmetric systems in mannitol.

67. "The relative strengths of ammonium and the substituted ammonium hydroxides as measured by their action on a pseudo-base. Part I." Charles Kenneth Tinkler.

The method employed depends on the spectroscopic determination of the amount of the ammonium form of a pseudo-base converted into the corresponding carbinol by the action of a soluble base. 1-Hydroxy-6:7-dimethoxy-2-methyltetrahydroisoquinoline has been employed as the pseudo-base.

By comparing the ultra-violet absorption spectra of the pseudo-base, in a solution of a soluble base, with those of mixtures of known composition of the hydro-compound (I) and the chloride (II),



it is possible to estimate the amount of the carbinol and ammonium forms of the substance present.

The general result of the investigation is to show that the bases employed increase in strength in the order: ammonium hydroxide, trimethylammonium hydroxide, methylammonium hydroxide, dimethylammonium hydroxide, tetramethylammonium hydroxide, which is in accordance with the results obtained by other investigators.

The present investigation has also shown that the conversion of the ammonium form of the pseudo-base into the carbinol is in accordance with the law of mass action, that is, concentration of ammonium form of pseudo-base \times concentration of hydroxyl ion = $K \times$ concentration of carbinol.

68. "The interaction between nitric acid and brucine in the presence of metallic nitrates." By Edward Henry Rennie and Alfred Ernest Dawkins.

The authors have investigated the effect of metallic nitrates on the interaction between nitric acid and brucine, and have found that the time required to produce a colour of standard depth is very much reduced by the addition of nitrates to the acid. This is in general accord with the results of previous investigations on the effect of nitrates on the interaction between nitric acid and copper (T., 1908, **93**, 1162; 1911, **99**, 1035).

69. "Derivatives of 3:4-dimethoxyacetophenone and 4:5-dimethoxy-*o*-tolyl methyl ketone: and the synthesis of phenylglyoxalines containing substituents in the benzene ring." By Henry Stephen and Charles Weizmann.

The authors have prepared some compounds derived from 3:4-dimethoxyacetophenone and 4:5-dimethoxy-*o*-tolyl methyl ketone, and also some new phenylglyoxalines.

4:5-Dimethoxy-*o*-tolyl chloromethyl ketone melts at 89° and boils at 180°/12 mm.; the corresponding dihydroxy-compound melts at 129° and boils at 187°/12 mm.

Compounds of the type of ω -chloroacetophenones were found on reduction with zinc dust and acetic acid to lead to the formation of acetophenones, with elimination of chlorine.

4:5-Dihydroxy-*o*-tolyl methyl ketone melts at 168°.

Phthalimino-3:4-dimethoxyacetophenone (compare D.R.-P. 209962), obtained from the corresponding chloro-ketone by con-

densation with potassium phthalimide and by condensation of veratrole with phthaliminoacetyl chloride, melts at 202°.

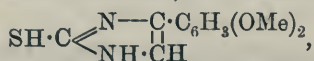
Phthalamino-3: 4-dimethoxyacetophenone melts at 174°; the amino-ketone hydrochloride obtained from this melts at 218° (compare Pictet, *Ber.*, 1909, **42**, 2943).

4: 5-Dimethoxy-o-tolyl phthaliminomethyl ketone melts at 159°, and the phthalamino-compound at 172°.

4: 5-Dimethoxy-o-tolyl aminomethyl ketone hydrochloride melts at 204°, and is similar to the lower homologue.

By condensation of the hydrochlorides of these aminoacetophenones with potassium thiocyanate and potassium selenocyanate (compare Gabriel, *Ber.*, 1894, **27**, 1037), the following glyoxaline derivatives were prepared:

2-Thiol-4-(3': 4'-dimethoxyphenyl)-glyoxaline,



melting at 132°, and 2-thiol-4-(3': 4'-dimethoxy-o-tolyl)-glyoxaline, melting at 155°.

The corresponding selenomercaptans melted at 115—117° and 163° respectively.

The above thiol compounds give the sulphur-free derivatives by oxidation with 10 per cent. nitric acid or ethyl nitrite.

70. "A delicate colorimetric method for detecting and estimating nitrates and nitrites." By Edmund Albert Letts and Florence Williamson Rea.

The authors have used diphenylbenzidine (Kehrmann and Micewitz, *Ber.*, 1912, **45**, 2641; Wieland, *Ber.*, 1913, **46**, 3300; compare also *Bull. Soc. chim.*, 1914, [iv], **15**, 186) for detecting and estimating small quantities of nitrates, the test being quite sensitive up to 0.00005 milligram of nitric nitrogen, the depth of blue colour depending on: (1) the temperature, the colour being deeper at higher than at ordinary temperatures; (2) the time that elapses after mixing the nitrate solution with sulphuric acid and diphenylbenzidine; and (3) the amount of nitrate present.

The estimation of nitrates by the new method depends on the depth of the blue tint, and is carried out in small porcelain crucibles. The method may also be employed for estimating both nitrites and nitrates in a mixture of the two.

71. "The solubility of the nitrates of potassium, barium, and strontium, and the stability of the double nitrate of potassium and barium." By Alexander Findlay, Idwal Morgan, and Ivor Prys Morris.

The isothermal curves for the system potassium nitrate-barium nitrate-water have been determined at the temperatures 9.1° , 21.1° , and 35.0° , and for the system potassium nitrate-strontium nitrate-water at the temperatures 20.0° and 40.0° . The formation of a double nitrate of potassium and barium was confirmed, and insight into its range of stability acquired. No evidence of the formation of a double nitrate of potassium and strontium was obtained.

72. "The azeotropic mixtures of ethyl acetate and water."
By Richard William Merriman.

Wade and Merriman (T., 1911, **99**, 997) defined an azeotropic mixture as one which distilled at a constant temperature without change of composition; such a mixture is necessarily one with a maximum or minimum boiling point. The definition is obviously only applicable to perfectly miscible liquids, but the extension of the term to partly miscible liquids or to non-miscible liquids should not cause confusion. For example, if a mixture of ethyl acetate and water containing 8.43 per cent. of water is distilled under a pressure of 760 mm., the boiling point remains constant at 70.37° , and the distillate contains 8.43 per cent. of water at every stage of the distillation. The boiling point is also a minimum to the extent that no other mixture of ethyl acetate and water has a lower boiling point; but, owing to the fact that this mixture of ethyl acetate and water of constant boiling point forms two layers right up to the boiling point, the composition of the mixture in the distilling flask may be varied within wide limits without affecting the boiling point or the composition of the distillate.* This fact was clearly pointed out by the author in the original communication (T., 1913, **103**, 1797), so that Lattey's criticism (this vol., p. 33) appears to be unnecessary.

The rest of Lattey's criticism cannot be applied to partly miscible liquids, such as ethyl acetate and water, as the whole of the deductions depend on the use of Duhem's equation, which is applicable only to perfectly miscible liquids.

* A mixture of any two liquids having two layers right up to the boiling point must form a mixture of constant boiling point with a minimum boiling point, and give a distillate having a constant composition.

In the accompanying figure (*loc. cit.*) the region above the line *AB* is experimentally unrealisable, but the dotted curve below *AB* is the most probable form of the *P/y* curve for mixtures of ethyl acetate and water, although mixtures of triethylamine and water give a curve of different shape (Lattey, T., 1907, **91**, 1965).

Lattey's assertion that the calculation given on p. 1799 of the original communication (*loc. cit.*) is simply an application of Dalton's law of partial pressures, is not strictly true. It is well known that Dalton's law of partial pressures can only be applied to mixtures of saturated vapours when the liquids are absolutely non-miscible (Young, "Stoichiometry," 253, 260).

73. "Diazotisation of aminomesitylenes." (Preliminary note.)

By Gilbert T. Morgan and Joseph Reilly.

Although the study of diazotisation processes is greatly simplified in the mesitylene series by the fact that coupling to form azo-derivatives is prevented by the symmetrical distribution of the three methyl substituents, yet comparatively little attention has been devoted to aminomesitylenes from this point of view.

Diaminomesitylene is readily converted into either *aminomesitylenediazonium chloride* or *mesitylenebisdiazonium sulphate*; the former salt yields *aminomesityleneazo- β -naphthol* (bright red needles, m. p. 173°), whilst the latter gives rise to *mesitylenebisazo- β -naphthol* (maroon-red nodules, m. p., indefinite, 270—275°). The bisazo-derivatives can also be produced by successively diazotising the monoazo-compound and coupling with β -naphthol.

Other diazonium salts illustrating the two stages of diazotisation of diaminomesitylene are under examination, together with the corresponding triazides and the azo-dyes obtained by coupling the mono- and bis-diazonium salts with 2:4-tolylenediamine and other bases and phenols.

74. "The variable rotatory powers of the *d*- α -bromocamphor- β -sulphonates." By William Jackson Pope and John Read.

In applying *d*- α -bromocamphor- β -sulphonic acid to the resolution of externally compensated bases, the authors have observed discrepancies amongst the molecular rotatory powers of the salts obtained; they now trace the latter to the occurrence of dynamic isomerism in the acid, and have been able to isolate stereoisomeric ammonium *d*- α -bromocamphor- β -sulphonates which exhibit the molecular rotatory powers $[M]_{D_{461}} + 371^\circ$ and $+176^\circ$.

75. "The optical activity of compounds of simple molecular constitution. Ammonium *d*- and *l*-chloriodomethanesulphonates." By William Jackson Pope and John Read.

The authors have prepared externally compensated chloriodomethanesulphonic acid, $\text{CHClI}\cdot\text{SO}_3\text{H}$, and have resolved it into its optically active components by crystallisation with *d*- and *l*-hydroxyhydrindamine, brucine, and strychnine. Ammonium *d*-chloriodomethanesulphonate has the molecular rotatory power $[\text{M}]_{5461} + 43.7^\circ$ in aqueous solution; the optical activity is very persistent, and the salt does not undergo racemisation when its aqueous solution is heated in a sealed tube at 130—150°.

76. "The lower limits of inflammation of methane with mixtures of oxygen and nitrogen." By Albert Parker.

The lower limits of inflammation of methane have been determined, when mixed with pure oxygen, when mixed with oxygen (80 per cent.) and nitrogen (20 per cent.), and so on down to an admixed gas containing only 13.5 per cent. of oxygen. The mixtures were sparked in a spherical glass vessel of 2.5 litres' capacity, the lower-limit mixture being taken as the one containing the smallest quantity of methane, in which the flame travelled throughout. With pure oxygen, the lower limit of methane is found to be 5.99 per cent., whereas with air the value is only 5.77 per cent. The most probable explanation of the higher value for oxygen is that the specific heat of oxygen is greater than that of nitrogen at the ignition-temperature of methane. A reduction in the oxygen content of the admixed gas from 20 to 13.5 per cent. causes an increase in the lower limit of methane to 6.29 per cent.

ANNUAL GENERAL MEETING.

The Annual General Meeting will be held on Thursday, March 26th, 1914, at 4.30 p.m., when the President will deliver his address, entitled "Recent Researches on Tautomerism."

At the next Ordinary Scientific Meeting, on March 19th, 1914, at 8.30 p.m., the following papers will be communicated:

"The ignition of some gaseous mixtures by the electric discharge." By H. F. Coward, C. Cooper and J. Jacobs.

"Deliquescence. Part I. The deliquescence of salts of ammonium bases." By C. J. Peddle.

"Hydrazoximes of methyl- and phenyl-glyoxals." By B. B. Dey.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30

No. 427

Thursday, March 19th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Reference was made to the loss sustained by the Society through the death of :

	Elected.	Died.
Daniel Bain (Gateshead).....	Feb. 21st, 1884	Feb. 5th, 1914
Harry Burrows (Southgate)	Feb. 19th, 1902	Mar. 15th, 1914
Robert Kennedy Duncan (Pittsburg) ...	May 3rd, 1906	Feb. 18th, 1914
Leonard Clifford Green (Brisbane).....	May 7th, 1908	July 13th, 1913
Christopher Clarke Hutchinson (Kensington)	Jan. 17th, 1884	Mar. 7th, 1914
Joseph William Thomas (Shortlands) ...	Feb. 18th, 1875	Mar. 3rd, 1914
Francis Vacher (Birkenhead)	Mar. 16th, 1882	Feb. 25th, 1914

Messrs. A. P. L. Blaxter and A. Bicknell were formally admitted Fellows of the Chemical Society.

The PRESIDENT announced that Professor Arrhenius has accepted the invitation of the Council to deliver the Faraday Lecture this year. The Lecture, entitled "Electrolytic Dissociation," will be delivered in the Theatre of the Royal Institution (by the courtesy of the Managers) on Monday, May 25th, at 6 p.m., and further particulars will be announced later.

Certificates were read for the first time in favour of Messrs. :

Charles Frank Armstrong, Marhourah Sugar Works, Marhourah,
B. & N.W. Railway, Saram, Behar, India.

Frederick Stanley Baxter, 119, Albert Street, Regent's Park, N.W.

Robert Odell Bishop, 1, Augustine Road, West Kensington, W.

Hugh Miller Galt, B.Sc., M.B., Elm Croft, Withdean, Brighton.

Trevor Edward Hodges, 43, Stapleton Hall Road, Stroud Green, N.

William Whalley Myddleton, M.Sc., 6, Fairfield Road, Latchford Without, Warrington.

A Certificate has been authorised by the Council for presentation to ballot under Bye-Law I (3) in favour of Mr.:

Birendranath Maitra, 10, Kalighat Road, Bhowanipur, Calcutta, India.

Of the following papers, those marked * were read:

- *77. "The ignition of some gaseous mixtures by the electric discharge." By Hubert Frank Coward, Charles Cooper, and Julius Jacobs.

The pressure of an explosive gaseous mixture may be reduced until ignition becomes impossible with the particular igniting arrangement in use. Such limiting pressures vary considerably with the strength of the igniting electric discharge (see Coward, Cooper and Warburton, T., 1912, 101, 2278, on the ignition of electrolytic gas), but comparable results for various mixtures are obtainable by preserving a constant igniting arrangement of induction coil, cells, spark-gap, etc. The ignition of an explosive mixture the composition of which does not approach too near to the dilution-limit of inflammability proves to be determined chiefly by (1) the energy effect of the discharge itself, a function of the composition and pressure of the mixture; (2) the thermal conductivity of the mixture; and probably (3) an activation of the oxygen. The ignition of such a mixture is therefore a question of strength of spark and maintained concentration of its energy until the end of the pre-flame period, rather than of the thermal effect of combustion in the path of the spark. Once a true flame is initiated in a homogeneous explosive mixture, its propagation is assured, except in very narrow vessels.

These considerations serve to explain some curious experimental results, of which the following may be quoted: A series of hydrogen-oxygen mixtures showed a rapidly falling ignition-pressure with increase in oxygen-content, until with 60 to 85 per cent. of

oxygen the ignition-pressure became almost constant. In one apparatus, electrolytic gas at 80 mm. pressure could be inflamed after the addition of (a) 23 mm. of electrolytic gas itself, or (b) 8 mm. of oxygen or more up to at least 720 mm., or (c) 90 mm. of hydrogen or more up to 210 mm.

Similarly, electrolytic gas much below its ignition-pressure has been ignited after the addition of suitable amounts of nitrogen, carbon dioxide, and even argon.

The cyanogen-oxygen, methane-oxygen, and ethylene-oxygen series of mixtures have been examined; also the carbon-monoxide-oxygen series, alone and with various diluents. The carbon monoxide experiments provided the chief evidence respecting the activation of oxygen in the discharge.

***78. "Hydrazoximes of methyl- and phenyl-glyoxals."**

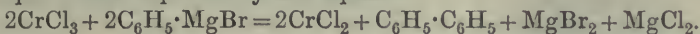
By Biman Bihari Dey.

The hydrazoximes of methylglyoxal, phenylglyoxal, and *iso*-nitrosomethylglyoxal, and their benzylidene, benzoyl and acetyl derivatives, as well as their corresponding azines, have been prepared. The semicarbazones and phenylcarbamylhydrazones of *iso*-nitroso-acetone, -acetophenone, etc., were also described.

***79. "The action of chromic chloride on the Grignard reagent."**

By George Macdonald Bennett and Eustace Ebenezer Turner.

It has been shown that when anhydrous chromic chloride is brought into contact with an ethereal solution of magnesium phenyl bromide, chromous chloride and diphenyl are produced in the quantities required by the equation



No organo-metallic derivatives of chromium could be isolated.

Besides diphenyl, very satisfactory yields of dibenzyl, 4:4'-dimethyldiphenyl, and *aa'*-dinaphthyl have been obtained by similar reactions. A reaction of the same kind was obtained using magnesium *iso*amyl iodide, but the yield of di-*iso*amyl was much less satisfactory.

***80. "The influence of solvents on molecular weights. Part I. Salts." By William Ernest Stephen Turner and Cornelius Theodore Pollard.**

Before any valid interpretation can be drawn of the results of molecular-weight measurements in solution, it is essential that the influence of the medium should be understood. This influence may be physical or chemical, and it is obvious that if the effect of

the solvent can be expressed by some physical rule, the interpretation of results is much simplified.

From an examination of existing data, the view had been expressed (Turner, T., 1911, **99**, 880) that the main factor influencing the value of the molecular weights of salts in solution is the dielectric character of the solvent, and in order to test how far this view was valid, a systematic review of the subject was undertaken, experiments being made, for the purpose, on chlorides, bromides, iodides, and a nitrate of organic ammonium bases, dissolved in fourteen solvents. To the new data obtained were added those previously obtained by one of the authors (Turner, *loc. cit.*, and T., 1912, **101**, 1923) and by other workers, bringing up the total to twenty-three solvents. The following conclusions were drawn:

(1) The molecular weight of an electrolyte is, in a general way, a function of the dielectric character of the solvent, and the statement (Turner, *loc. cit.*) that electrolytic dissociation and molecular association are complementary phenomena, the former appearing in solvents of high, the latter in those of low, dielectric constant, is amply confirmed.

p-Toluidine, of low dielectric constant, is exceptional, but the low results found in this solvent with most of the substances dissolved may be due to combination. Nitrobenzene, in which certain organic substances are strongly associated, falls into line as a solvent for iodides and nitrates, producing apparent dissociation in accordance with its high dielectric constant.

(2) Whilst no sharp line can be drawn, association of a salt occurs, in moderately dilute solutions, when the dielectric constant of the solvent falls below 18, but the extent of association depends both on the solvent and the solute.

(3) For solvents of low dielectric constant, the degree of association is not strictly parallel to the dielectric constant.

(4) As a general rule, the degree of association of similarly constituted salts falls in the order iodide > bromide > chloride, both in associating and dissociating solvents, thereby affording further evidence of the complementary character of association and dissociation.

Chlorides, in some cases, behave exceptionally.

(5) Rise of temperature has a marked influence in decreasing the degree of association of salts.

(6) The common view that associated substances dissolved in associated solvents become thereby dissociated is disproved in the case of salts. Such simplification only occurs when the associated solvent possesses also a high dielectric constant.

81. "Deliquescence. Part I. The deliquescence of salts of ammonium bases." By Cyril James Peddle.

Little or no previous systematic study of deliquescence appears to have been made, descriptions of the deliquescence of substances being either the result of visual tests or of exposing a known weight of material on a watch-glass or other vessel. Both methods are crude, and have been proved by experience to be deceptive.

The chief factors influencing deliquescence are the temperature and humidity of the atmosphere, the area and depth of the substance used, and the size of the particles of the exposed material. In order to obtain accurate values, all these factors must be allowed for, especial care being taken to ensure the air being constantly saturated with moisture.

The amount of water absorbed by 1 gram of substance is termed the deliquescence of that substance, and results have been obtained accordingly. In addition, the number of gram-molecules of water absorbed by 1 gram-molecule of salt was calculated, this value being termed the molecular deliquescence. Some evidence of the rate of absorption was obtained from the ratio

$$\frac{\text{molecular deliquescence}}{\text{time of exposure}}.$$

Amongst homologous compounds, additive properties are absent, the phenomenon of deliquescence appearing to be only constitutive. Solubility is also related to deliquescence, although the relation is a complicated one, being most marked in the case of chlorides.

In general, the order of deliquescence in a series falls with increase in molecular weight, and in the case of corresponding haloid salts the chloride is most deliquescent and the iodide least. The introduction of aromatic radicles brings about a large decrease in deliquescence, whilst salts containing only aromatic radicles are non-deliquescent.

Many of the salts examined had a deliquescence comparable with that of common inorganic drying agents.

82. "Some derivatives of *as*-dipropyl- and diamyl-oxamic acids." By Harford Montgomery Atkinson.

Dipropylamine and diamylamine easily react with ethyl oxalate, forming the esters of dipropyl- and diamyl-oxamic acids. The following derivatives were described:

Ethyl dipropyl-oxamate, $\text{CO}_2\text{Et}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, b. p. $143^\circ/10$ mm.,

which, by the action of ammonia, gives *as-dipropylloxamide*, $\text{NH}_2\cdot\text{CO}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, m. p. 96—97°.

as-Dipropylloxamonitrile, $\text{CN}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, b. p. 120°/14 mm., which, when treated with hydrogen sulphide, yields *as-dipropylthioxamide*, $\text{NH}_2\cdot\text{CS}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, m. p. 129—130°.

Thiopiperidylglyoxylamide, $\text{NH}_2\cdot\text{CS}\cdot\text{CO}\cdot\text{NC}_5\text{H}_{10}$, crystals, m. p. 66—67°; *thio-as-diethyloxamide*, $\text{NH}_2\cdot\text{CS}\cdot\text{CO}\cdot\text{N}(\text{C}_2\text{H}_5)_2$, m. p. 126—127°; *thio-as-dimethyloxamide*, m. p. 120—121°.

Dipropylloxamic acid, $\text{CO}_2\text{H}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, m. p. 73—74°, and its *chloride*, $\text{COCl}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, b. p. 112—116°/14 mm., which, with dipropylamine, gives *tetrapropylloxamide*, $[\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2]_2$, m. p. 38—39°, and by the action of heat furnishes *dipropylcarbamyl chloride*, $\text{COCl}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, b. p. 118—120°/28 mm.; *piperidine-1-carboxyldipropylamide*, $\text{C}_5\text{H}_{10}\text{N}\cdot\text{CO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, b. p. 173°/10 mm.; *dipropyldiamylcarbamide*, $\text{N}(\text{C}_3\text{H}_7)_2\cdot\text{CO}\cdot\text{N}(\text{C}_5\text{H}_{11})_2$, b. p. 185°/12 mm.; *dipropylformamide*, $\text{HCO}\cdot\text{N}(\text{C}_3\text{H}_7)_2$, b. p. 102°/17 mm.; *ethyl diamyloxamate*, $\text{CO}_2\text{Et}\cdot\text{CO}\cdot\text{N}(\text{C}_5\text{H}_{11})_2$, b. p. 166—167°/10 mm.; *as-diamyloxamide*, $\text{NH}_2\cdot\text{CO}\cdot\text{CO}\cdot\text{N}(\text{C}_5\text{H}_{11})_2$, m. p. 182°; *diamylformamide*, $\text{HCO}\cdot\text{N}(\text{C}_5\text{H}_{11})_2$, b. p. 141—145°/18 mm.; *diamylcarbamyl chloride*, $\text{COCl}\cdot\text{N}(\text{C}_5\text{H}_{11})_2$, b. p. 147—149°/14 mm.; and *phenyldiamylcarbamide*, $\text{C}_6\text{H}_5\cdot\text{NH}\cdot\text{CO}\cdot\text{N}(\text{C}_5\text{H}_{11})_2$, m. p. 204.

83. "The system silver-silver sulphide."

By Crellyn Colgrave Bissett.

The above system has been investigated both by thermal and by microscopic methods. From the results of the investigation it was concluded that: (1) Silver and silver sulphide are only partially miscible in the liquid state. All alloys having an average composition between approximately 17 and 94 per cent. of sulphide separate into two layers on being melted, and freeze at a constant temperature of 903°.

(2) Silver and silver sulphide form a eutectic containing approximately 99 per cent. of sulphide. The freezing point of the eutectic was found to be 804°.

(3) Silver and silver sulphide probably form solid solutions to some extent.

84. "The action of sulphur on amines. Part II. Aniline."

By Herbert Henry Hodgson and Alfred Gilbert Dix.

The authors have studied the action of sulphur on aniline in the presence of its hydrochloride or hydrochloric acid. It is found that trithioaniline is produced in quantitative yield, and the

previous discrepancies of other authors are to be explained by secondary actions between the trithioaniline, aniline, and sulphur. Although the free base itself could only be obtained in a resinous condition, the *sulphate*, *hydrochloride*, and *oxalate* have been prepared, together with the *benzoyl* derivative. The wool dyestuffs obtained by diazotising the sulphate and combining with the usual components were found to be exceptionally fast to ordinary agents, and particularly so to milling. Iodine had the same influence as hydrochloric acid on the course of the reaction. On reduction the trithioaniline gives a dithioaniline, but the poor yield has led to an investigation of the mechanism of the reduction. Anomalies noticed when trithioaniline is condensed with *m*-nitrobenzaldehyde, and also when diazotised and coupled with β -naphthol, seem to indicate that one of the sulphur atoms is only loosely combined.

85. "Investigations on the dependence of rotatory power on chemical constitution. Part VI. The optical rotatory powers of methyl-*tert*.-butyl-, methylbenzyl-, methylphenylethyl- and methyl- α -naphthylcarbinols."* By Robert Howson Pickard and Joseph Kenyon.

The preparation of the optically active forms of these carbinols was described.

1-Methyl- α -naphthylcarbinol (m. p. 47°), when supercooled at the temperature of the laboratory, exhibits anomalous rotatory dispersion.

86. "Salts which contain two solvents of crystallisation."

By James Ernest Marsh.

When the salt $\text{KHgI}_3 \cdot \text{H}_2\text{O}$ is added to methyl carbonate, the clear, yellow crystals crumble to a nearly colourless powder. On warming, all passes into solution, and on cooling the salt $\text{KHgI}_3 \cdot \text{H}_2\text{O} \cdot 3\text{Me}_2\text{CO}_3$ crystallises out. The ammonium salt $\text{NH}_4\text{HgI}_3 \cdot \text{H}_2\text{O} \cdot 2\text{Me}_2\text{CO}_3$ crystallises well. The rubidium salt $\text{RbHgI}_3 \cdot \text{H}_2\text{O} \cdot 2\text{Me}_2\text{CO}_3$ is also crystalline, but nearly insoluble in the solvent. A sodium silver iodide with water and methyl carbonate of crystallisation has also been obtained.

* This paper corresponds in part with the preliminary note published in P., 1912, 28, 42.

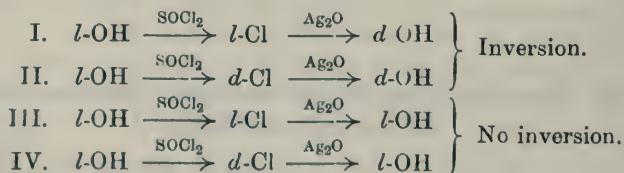
87. "Menthyl esters of chloroacetic, menthoxyacetic, and methyl-anilinoacetic acids." By Percy Faraday Frankland and Fred Barrow.

These compounds have been prepared by the authors in connexion with their search for an optically active acid chloride which would be easily accessible and not liable to racemisation.

Owing to the great stability of the ester-grouping in menthyl chloroacetate, the authors find the latter to be a very convenient optically active compound from which to obtain derivatives by the interaction of the halogen-atom and other groups. Thus menthyl menthoxyacetate and menthyl methylanilinoacetate were obtained by the action of sodium menthoxide and methylaniline, respectively, on menthyl chloroacetate. (Compare also the use made by P. F. Frankland and H. H. O'Sullivan of menthyl chloroacetate and menthoxyacetic acid, T., 1911, 99, 2325; 1912, 101, 287.)

88. "The action of thionyl chloride on lactic acid and on ethyl lactate." By Percy Faraday Frankland and William Edward Garner.

The authors direct attention to the apparent regularity in the action of thionyl chloride and silver oxide on optically active hydroxy-compounds. Four possibilities present themselves:



Only six hydroxy-compounds have hitherto been investigated in their relation to this pair of reagents, and in every case an inversion is effected, the transformation taking place according to scheme I in the case of phenylglycollic acid (mandelic acid), α -hydroxy- α -phenylpropionic acid (atrolactic acid), β -hydroxy- β -phenylpropionic acid, and phenylmethylcarbinol, and according to scheme II in the case of malic acid and α -hydroxy- β -phenylpropionic acid, although for the latter compound the data are incomplete and somewhat obscure. Hitherto no transformations according to schemes III and IV have been observed.

The authors have completed the data bearing on lactic acid, for which the following transformations are already known:

One of these modifications is ochreous and the other red, the latter being regarded as an inner salt (II) and the former as having the normal constitution (I). Both forms dissolve in alkali with a yellow colour; the authors give reasons for believing that in alkaline solution configuration III exists, this form reverting at once to I when precipitated by acids.

90. "A formula by means of which the molecular volume at the boiling point may be calculated." By Gervaise Le Bas.

In an extended study of molecular volumes, it was found necessary to calculate some of the values at the boiling point, and the following formula has been found suitable for this purpose:

$$\frac{273}{\text{B. p.}} = \left\{ 1 - c \left(\frac{d_t}{d_0} - 1 \right) \right\}.$$

The only data necessary are the density at 0° and the boiling point.

The value of c is given in the following table, the data being those of Thorpe:

Table of Values (Inorganic Compounds).

Compound.	B. p.	d_0 .	$d_{\text{B. p.}}$	c .	M.V. calc.	M.V. obs.	% error.
$\text{S}_2\text{O}_5\text{Cl}_2$	139.6	1.85846	1.60610	0.460	135.5	135.5	± 0.0
$\text{SO}_2\text{Cl}\cdot\text{OH}$	155.3	1.78474	1.54874	0.420	75.5	75.05	+ 0.7
SO_2Cl_2	70.0	1.70814	1.56025	0.462	86.3	86.3	± 0.0
AsCl_3	130.2	2.20500	1.91813	0.447	95.1	94.37	+ 0.76
AsF_3	60.4	2.6659	2.4497	0.490	53.6	53.84	- 0.44
VOCl_3	127.2	1.86534	1.63073	0.452	106.5	106.2	+ 0.3
POBrCl_2	137.6	2.12065	1.83844	0.458	107.5	107.4	+ 0.1
PSCl_3	125.1	1.66820	1.45599	0.455	116.3	116.1	+ 0.2
POCl_3	107.2	1.71163	1.50967	0.474	101.0	101.4	- 0.4
TiCl_4	136.4	1.76041	1.52223	0.460	124.5	124.5	± 0.0
SiCl_4	57.6	1.52408	1.40294	0.500	120.2	120.8	- 0.5
N_2O_4	21.6	1.49030	1.43958	0.473	64.0	63.9	± 0.0

Mean value, 0.463

It is found that by means of the above formula the volumes of compounds of a similar order of complexity can be calculated to within 1 per cent.

Example.— GeCl_4 , d_{18} 1.887 (Winkler), b. p. 86.0° , $\frac{253}{T'} = 0.771$,

$\frac{d_0}{d_t} = 0.46 \times 0.229 = 1.1053$, $d_{\text{b. p.}} = \frac{1.887}{1.105} = 1.708$. M.W. = 213.8; M.V.

124.6.

Observed, C 14.8, Si 32, Ge [36.2], Sn 42.3, Ti [35.7].

The formula can be used indifferently for inorganic and organic compounds, but the value of c in the latter varies somewhat as the compounds vary greatly in complexity and the chains lengthen.

The value of c for organic cyclic compounds without side-chains is similar to the above.

Cyclic Compounds.

Compounds.	M. p. or 0°.	B. p. or m. p.	d_4^{25}	d_4^{20}	d_4^{15}	M. V. calc.	M. V. obs.	% error
C ₆ H ₆ (Benzene) ...	6.0°	80°	0.8940	0.8133	0.470	95.7	96.0	-0.03
C ₄ H ₄ S (Thiophen)	0.0	84	1.0884	0.9874	0.434	85.5	85.0	+0.6
C ₁₀ H ₈ (Naphthalene)	79.2	217	0.9777	0.8674	0.456	147.3	147.2	±0.0
C ₁₀ H ₁₄ (Hexahydro- naphthalene) ...	0.0	200	0.9419	0.7809	0.487	170.0	171.2	-0.7
C ₁₄ H ₁₀ (Phen- anthrene)	100.5	340	1.0630	0.9073	0.440	197.8	195.2	+1.3
C ₅ H ₅ N (Pyridine)...	0.0	115	1.0033	0.8826	0.462	89.3	89.3	±0.0
C ₉ H ₇ N (Quinoline)	0.0	234	1.1081	0.9211	0.439	141.1	140.0	+0.8
Mean value,						0.460.		

The results of calculation show very fair agreement with observation, and thus giving a fairly trustworthy method for the calculation of unknown values.

Example.—*Hydrindene*, C₉H₁₀: d_4^{25} 0.957, b. p. 176°, $c=46$, M.V. 144.0. $\Sigma nV_a = (4 \times 9 + 10)3.7 = 46 \times 3.7 = 170.2$, $\Delta = -26.2$ for ring. Contraction for 1 six-membered ring + 1 five-membered ring = $-15 - 11.5 = -26.5$.

Acenaphthene, C₁₂H₈.—The value of c for phenanthrene is 0.440. For acenaphthene, d_{103}^{25} 1.030, m. p. 103°, b. p. 277°. V_m 166.6, ΣnV_a 207.2, $\Delta = -40.6$. Contraction for 2 six-membered rings + 1 five-membered ring = $-30.0 - 11.5 = -41.5$.

The only difficulty is met with in open-chain organic compounds.

For compounds like chloroform, carbon tetrachloride, and trichloromethane, the value of c mentioned above (0.460) may suffice.

c , in general, increases by 0.024 for every addition of CH₂ in open-chain compounds, thus:

$$\begin{array}{ccc} \text{C}_5\text{H}_{12} & 0.476, & \text{C}_6\text{H}_{14} & 0.500, & \text{C}_7\text{H}_{16} & 0.532, & \text{C}_8\text{H}_{18} & 0.554, \\ \Delta & 0.024 & & 0.032 & & 0.022 & & \end{array}$$

When considering an unknown value for a certain compound, it is usually possible to find an analogous compound from which c may be calculated, for example, cymene, C₁₀H₁₄, for the terpenes (menthane), C₁₀H₁₆, methyl succinate for methyl maleate or fumarate, propionitrile for ethyl carbylamine, and ethyl nitroethane for ethyl nitrite.

91. "A study of the constitution of nitrogen and phosphorus oxides and some of their derivatives by means of molecular volumes."

By Gervais Le Bas.

A study has been made of the above compounds by means of a new theory of molecular volumes, based on the original one of Kopp, or at least from his point of view. It recognises an additive

principle, which is shown by the use of a system of atomic volumes, as follows: C=14·8, H=3·7, O=7·4—11·0, according to circumstances, S=22·0 and 25·6, N=15·6, P=27·0. A number of constitutive features are also recognised. As a consequence, the constitutions of some of the above compounds are considered to be different from those usually accepted.

INFORMAL MEETING.

The Rooms of the Society will be open for an informal meeting of the Fellows on Thursday, April 30th, from 8 to 10 p.m. Smoking will be permitted, and light refreshments will be provided. Fellows are invited to exhibit apparatus and specimens of interest, and to show experiments; those wishing to do so are requested to communicate with the Honorary Secretaries not later than the Monday previous to the meeting.

The next Ordinary Scientific Meeting will be held on Thursday, April 2nd, 1914, at 8.30 p.m., when the following papers will be communicated:

"The system: ethyl ether-water-potassium iodide-mercuric iodide. Part III. Solutions unsaturated with respect to solid phases in the four-component system." By A. C. Dunningham.

"The velocity of saponification of acyl derivatives of phenols. Part I. The velocity of saponification of phenyl benzoate." By H. McCombie and H. A. Scarborough.

"A general method for the preparation of glyoxals and their acetals." By H. D. Dakin and H. W. Dudley.

"The action of sulphuric acid on *p*-para-formaldehyde." By J. G. M. Dunlop.

"The constitution of the glycerylphosphates. The synthesis of α - and β -glycerylphosphates." By H. King and F. L. Pyman.

"The destructive distillation of soil." (Preliminary note.) By E. J. Holmyard.

"Addition products of nitro-compounds and amines." (Preliminary note.) By H. Housley.

"Dibenzoylglucoxylose, $C_{11}H_{18}O_{10}(CO \cdot C_6H_5)_2, H_2O$. A natural benzoyl derivative of a new disaccharide." By F. B. Power and A. H. Salway.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30.

No. 428.

Thursday, March 26th, 1914, Annual General Meeting, Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Dr. M. O. FORSTER drew attention to an article signed by Professor H. E. Armstrong, appearing in the *Chemical World* for March, 1914, and asked the President the following question:

“What action have the Council taken or do they propose taking to defend one of their salaried officials from an imputation of inefficiency uttered in a public journal by a Vice-President who has filled the office of President?”

The PRESIDENT, in reply, stated that the matter had received the earnest attention of the Council, who had passed the following Resolution:

“That the Council of the Chemical Society emphatically repudiates the uncalled-for remarks made by Professor Armstrong in an article in the March, 1914, number of the *Chemical World* which appear to imply literary incompetence on the part of the Editor of the Society's Publications, and offers to Dr. Cain an expression of its continued confidence in and appreciation of his work as Editor.”

and that a copy of this Resolution had been sent to Professor H. E. Armstrong, Dr. J. C. Cain, and also to the Editor of the *Chemical World*, asking him to insert the Resolution in a prominent position in the next number of that journal.

Dr. G. D. LANDER and Dr. F. L. PYMAN were appointed Scrutators, and the ballot was opened for the election of Officers and Council for the ensuing year.

The Report of the Council on the Progress of the Society during the past year was presented, and the Treasurer made a statement as to the income and expenditure. The adoption of the Report of Council, together with the Balance Sheet and Statement of Accounts for the year ended December 31st, 1913, was proposed by Dr. N. V. SIDGWICK, seconded by Dr. R. H. PICKARD, and carried unanimously.

A vote of thanks to the Auditors was proposed by the TREASURER and acknowledged by Dr. S. RIDEAL.

REPORT OF COUNCIL, 1913—1914.

THE Council are gratified to be able to report that the membership of the Society has continued to expand during the past year. On December 31st, 1912, the number of Fellows was 3,158. During 1913, 164 Fellows were elected, and 2 have been reinstated, making the gross total of 3,324. The Society has lost 26 Fellows by death, 40 Fellows have resigned, the elections of 7 Fellows and 1 reinstatement have become void, and 49 Fellows have been removed for non-payment of annual subscriptions.

The total number of Fellows, therefore, on December 31st, 1913, was 3,201, showing an increase of 43 over that of the preceding year. On comparing these figures with those given in the previous Report of Council, it will be noticed that the number of elections in 1913 has dropped to the average for the previous six years. The resignations received in 1913 are less by 12 than in the previous year, whilst the number of Fellows removed for non-payment of annual subscriptions still continues very high, notwithstanding the latitude allowed by the Council.

The names of the deceased Fellows, with date of election, are:

Gustavus Anthony Abrines	Angelo Cantin (1900).
(1890).	Arthur Crozier Claudet (1902).
Matthew Algernon Adams	Tom Crossman (1895).
(1877).	James Tudor Cundall (1887).
Edward Louis Barret (1869).	Joseph Davidson (1876).
J. Carter Bell (1865).	Leopold Mandeville Deane
William Popplewell Bloxam	(1886).
(1883).	Frank Standish Findon (1905).

Leonard Clifford Green (1908).	Isaac Patchett (1870).
Sir Walter Noel Hartley (1866).	Thomas Ebenezer Pye (1906).
John Heron (1876).	Mathura Goolab Roy (1900).
John Hunter (1883).	Christer Peter Sandberg (1870).
Julius Lewkowitsch (1888).	Walter Shelley Spencer (1887).
Hugh Marshall (1890).	William Tate (1890).
George Matthey (1870).	Arthur Wallace (1912).

The following Fellows have resigned :

Maurice Barrett.	Edward Towyn Jones.
Cyril Bergtheil.	James Kewley.
Henry Charles Bond.	James Kirkman King.
John Brock.	William Albert Knight.
William Arthur Caldecott.	Alfred Tabois Larter.
George Clayton.	Arthur Stanley Lindley.
Alfred Bertram Coles.	Robert Drysdale MacKechnie.
Harry Dunlop.	William Rest Mummery.
Percy Elford.	Henry John Palmer.
Charles Albert Fawsitt.	John Lawrence Robinson Past- field.
James Edward Ferguson.	Richard Pribram.
Hans Eduard Fierz.	Isaac Sydney Scarf.
John Thomas Furnell.	Harold Victor Taylor.
William Hunter Gandy.	Everard Cecil Van Essen.
Charles Maurice Walter Grieb.	Norbert Van Laer.
James Gordon Hardy.	Percy Wharton Waters.
Walter Elmslie Hawkins.	James Simpson Chester Wells.
Charles Theodore William Hirsch.	Sidney Whalley.
George Edward Holden.	Herbert Goulding Williams.
Bernard Farmborough Howard.	Frederick Robert Leyland Wilson.

The number of Honorary and Foreign Members at the end of 1912 was 33. During 1913, Professor D. P. Konvaloff and Professor Alfred Werner were elected; the total number of Honorary and Foreign Members at the present time, therefore, is 35.

In accordance with the announcement made in the Annual Report presented in March of last year, the following Report deals with the work of the Society during the period between that date and the present Annual General Meeting.

The Council offers its hearty congratulations to Professor George Downing Liveing (elected November 21st, 1853), who has com-

pleted over sixty years of Fellowship, and to the following, who have reached their Jubilee:

Mr. William Spiller, elected January 15th, 1863.

John Whitfield, elected November 5th, 1863.

Professor John Wrightson, elected February 4th, 1864.

Mr. Henry Bassett, elected February 18th, 1864.

During the year, 355 scientific communications were made to the Society; 253 of these have been published already in the Transactions, and abstracts of all have appeared in the Proceedings.

The volume of Transactions for 1913 contains 2,296 pages, of which 2,173 are occupied by 238 memoirs, the remaining 123 pages being devoted to the Obituary Notices, the Ladenburg and Van't Hoff Memorial Lectures, the Report of the International Committee on Atomic Weights, the Report of the Annual General Meeting, and the Presidential Address; the volume for the preceding year contained 266 memoirs occupying 2,431 pages.

The Journal for 1913 contains 5,978 abstracts, which extend to 2,520 pages, whilst the abstracts for 1912 numbered 5,497, and occupied 2,264 pages.

In accordance with an announcement made at the last Annual General Meeting, a change has been made in the arrangement of the abstracts, those of Physiological Chemistry and the Chemistry of Vegetable Physiology and Agriculture being included in Part I instead of in Part II, as heretofore. This has led to approximate equality in the size of the two parts.

	No. of pp. in 1913.	No. of pp. in 1912.
Part I	1432	1044
Part II (with indexes)	1528	1614

The abstracts may be classified as follows:

PART I.		
	Pages.	No. of Abstracts.
Organic Chemistry		1,824
Physiological Chemistry		771
Chemistry of Vegetable Physiology and Agriculture		442
	1,432	3,037

PART II.

	Pages.	No. of Abstracts.
General and Physical Chemistry		1,401
Inorganic Chemistry		555
Mineralogical Chemistry		159
Analytical Chemistry		826
	1,088	2,941
Total in Parts I. and II.	2,520	5,978

Following the proposal made by the Deutsche Physikalische Gesellschaft, the Council have decided to request authors to insert either their University, Laboratory, or private address at the end of all papers appearing in the Transactions. It is hoped that by this means communication between authors of papers in various journals will be facilitated.

During the past year, advantages have been offered to Fellows of the Society by the reduction in price of certain publications. Arrangements have been made by which Fellows can obtain Vol. I. of the *Literatur Register*, by R. Stelzner, at the reduced price of £3 10s. (original price, £4 4s.), provided that not less than twenty copies of the work be purchased by Fellows. Application for this volume should be addressed to the Honorary Secretaries. Fellows will also be able to purchase the forthcoming Vol. III of the *International Tables of Physical Constants and Numerical Data* at the reduced prices of 19s. 3d. (unbound) or £1 2s. 3d. (bound).

Vol. V of the *Collective Index of the Journal and Proceedings of the Chemical Society (1903—1912)* has been issued during the year, Part I (Author Index) appearing in May and Part II (Subject Index) in December. The price of this volume is now £2 to Fellows and £2 10s. to the public.

The Council have decided to offer the *Jubilee Volume* (giving a history of the Society from 1841 to 1891), which was published at 6s., at the reduced price of half-a-crown, and also to dispose of a few bound sets of the *Journal of the Chemical Society*, from 1871 to 1900 inclusive (published at £47 10s.), at £20 for the series.

The attention of Fellows is directed to the appearance of a French translation of Vol. IX of the *Annual Reports*. Permission was granted to the Director of the *Laboratoire Municipal de Paris* for the production of this translation; it was published by Messrs. Hermann et Fils in October last at the price of Fr. 7.50.

An intimation has been received from the *Faraday Society* that

this body is prepared to consider the election to membership of a certain number of Fellows of the Chemical Society without payment of an entrance fee.

The Transactions for 1913 contain obituary notices of Paul Emile Lecoq de Boisbaudran, Edward Divers, Humphrey Owen Jones, John William Mallet, Henry de Mosenthal, Benjamin Edward Reina Newlands, John Pattinson, Arthur Richardson, John Wade, and William Ord Wootton, who died during 1912, and the Council desire to express their indebtedness to the Fellows who wrote these notices.

The Council also wish to record their thanks to those Fellows who contributed to Vol. X of the Annual Reports.

During the past year, the Society has been privileged to listen to Memorial Lectures on Jacobus Henricus van't Hoff, delivered by Professor James Walker, and Albert Ladenburg, delivered by Professor F. Stanley Kipping. In the last Report of Council it was stated that when these two Lectures had been delivered the Council would publish Vol. II of the Memorial Lectures. This volume has now been issued (price 6s.), and can be obtained from the Publishers or from the Assistant Secretary.

The Council have under consideration the desirability of re-issuing Vol. I of the Memorial Lectures (now out of print). To assist them in arriving at a decision in the matter, a circular was issued with Proceedings No. 423 inviting those Fellows who would be willing to purchase Vol. I (price 10s. 6d.) to notify the Assistant Secretary.

The Council are pleased to announce that the Faraday Lecture is to be delivered by Professor Svante August Arrhenius, F.R.S., on Monday, May 25th, 1914, at 6 p.m., in the Theatre of the Royal Institution (by the courtesy of the Managers). The title of the Lecture is "Electrolytic Dissociation."

To meet the convenience of Fellows, the Council decided that a list of the papers to be read at each Ordinary Scientific Meeting of the Society should be advertised in the *Morning Post* on the Wednesday previous to the day of meeting. This list of papers appears on the front page, at the top of the extreme right-hand column.

The stock of apparatus and reagents for the use of Fellows making experiments at the meetings of the Society has been replenished. A list of such apparatus and reagents can be obtained from the Assistant Secretary.

In order to afford Fellows an opportunity of meeting informally, the Rooms of the Society were open on the evening of January 15th, 1914, when the President and Council were present to receive

the Fellows. The Council have decided to provide for a similar meeting on Thursday, April 30th, from 8 to 10 p.m.

The Anniversary Dinner of the Society was held at the Whitehall Rooms, Hôtel Métropole, on March 14th, 1913, Professor Percy F. Frankland, the retiring President, occupying the Chair. An abbreviated account of the speeches made, together with a list of the names of the Fellows and their guests who were present, appears in the Proceedings, p. 94.

It is with very great pleasure that the Council have to report that a bust of the Right Honourable Sir Henry Enfield Roscoe, by Mr. Alfred Drury, R.A., has been presented to the Society by the friends and former students of Sir Henry Roscoe. The presentation was made before a distinguished company in the Rooms of the Society on November 20th, and the bust now adorns the Library.

The meeting of the International Association of Chemical Societies was held in Brussels instead of in London, as previously arranged, in September, the Society being represented by Sir William Ramsay, K.C.B., Professor Percy F. Frankland, and Professor Arthur W. Crossley. An abbreviated report of the meeting appears in the Proceedings, p. 325. Thanks to the generosity of M. Ernest Solvay, the Association is now endowed with a sum of Frs. 250,000, in addition to a yearly income of Frs. 37,500 for twenty-eight years, and a site for offices in Brussels.

To celebrate the centenary of the birth of Sir John Bennett Lawes in 1814, and of Sir Henry Gilbert in 1817, it is proposed to erect a Commemoration Laboratory at Rothamsted. Fellows have been invited to respond to the appeal which is being made to raise £6,000, this being half the total amount required for the memorial, the other half having been promised in the form of a grant.

Mention was made in the last Report of Council that the sum of £65 4s. had been subscribed by the Fellows of the Chemical Society towards the van't Hoff Memorial. In April, 1913, the total sum of Fl. 56,000 had been received by the Committee, and a statement with reference to the disposal of this fund is given in the Proceedings, p. 167.

The Council have decided to make a further contribution of £10 to assist the International Commission to prepare the fourth volume of the International Tables of Constants and Numerical Data.

The number of books borrowed from the Library during the year 1913 was 1,730, as against 1,825 the previous year; of these, 546 were issued by post, as against 491 in the preceding year.

The Additions to the Library comprise: 137 books, of which 68 were presented, 510 volumes of periodicals (representing 241 journals), and 86 pamphlets, as against 135 books, 482 volumes of periodicals (representing 237 journals), and 76 pamphlets last year.

The question of providing for the continuous growth of the Library has been further considered, and a room in the basement has been altered to accommodate 27 rolling book-stacks, estimated to contain 8,500 volumes, or twelve years' addition to the Library at its present rate of growth.

From a purely financial point of view, the past year was not so successful as the year immediately preceding it. Notwithstanding the considerable cost of the redecoration and the improvements in the ventilation of the Society's Rooms, there was a balance in 1912 of £176 1s. 7d., whilst in 1913 there is a deficit of £237 7s. 7d. on the year's working. A careful examination of the statement of income and expenditure, however, will show that this need cause no alarm. From all sources, the income for 1913 amounts to £9,235 14s. 1d., as against £8,120 12s. 3d. in 1912, an increase of £1,115 1s. 10d., whilst the corresponding expenditures are £9,473 1s. 8d. and £7,944 10s. 8d., an increase of £1,528 11s. The income, as well as the expenditure, is a record one, and the amount of each has been raised by a common cause. The printing of Volume V. of the Decennial Index alone has added £1,378 to the normal expenditure, whilst somewhat over £1,000 has already been added to income from its sale. Remembering that Part II. (Subject Index) was only published in December last, it may confidently be anticipated that sales of this volume in the near future may very considerably reduce, if not altogether obliterate, the deficit arising from this source.

Another exceptional expenditure which could not be delayed was the provision of new iron bookcases for the extension of the Library in one of the basement rooms at a cost of £155 13s. The extra cost of the Journal this year was due to the increase of about £63 in Abstractors' fees, and a consequent increase of equal amount in the cost of printing. The cost of the Annual Reports on The Progress of Chemistry for 1912 exceeded that for 1911 by £51. It is to be regretted that the amounts received as Life Compositions and Admission Fees were £141 less than in 1912, when they were, however, considerably above the average.

In the balance-sheet a sum of £168 1s. 10d. appears as an asset, having been paid on account of the International Association of Chemical Societies. This temporary expenditure is owing to the meeting of the Association having been originally arranged to take place in London, but it will shortly be repaid to the Society from

BALANCE SHEET.—THE CHEMICAL SOCIETY, 31ST DECEMBER, 1913.

97

Liabilities.

	£	s.	d.	£	s.	d.
To Subscriptions received in advance .. .. .	...	...	...	299	10	0
" Sundry Creditors .. .. .	...	...	...	2173	7	4
" Research Fund :—						
As per last Balance Sheet	10481	5	6			
Add Excess of Income over Expenditure for the year	50	7	8	10531	13	2
Chemical Society : Excess of Assets over Liabilities :—						
As per last Balance Sheet... .. .	20569	9	4			
Less Excess of Expenditure over Income for the year	237	7	7	20332	1	9

Assets.

	£	s.	d.	£	s.	d.
By Investments (value when acquired) :—						
£6780 Metropolitan Consolidated 3½ per cent. Stock	7212	8	6			
£1050 London and North Western Railway 3 per cent. Debenture Stock	889	12	0			
£1520 14½ 3d Cardiff Corporation 3 per cent. Stock	1650	0	0			
£1400 India 3d 2½ per cent. Stock	1316	1	0			
£2400 Bristol Corporation 2½ per cent. Debenture Stock	2070	2	0			
£4341 Leeds Railway 2½ per cent. Preference Stock	3572	2	5			
£1200 Leicestershire Corporation 3 per cent. Stock	1143	1	0			
£1500 Transvaal 3 per cent. Guaranteed Stock, 1923/53	1460	13	6			
£1200 North British Railway 3 per cent. Debenture Stock	1038	11	0			
£700 Canada 3½ per cent. Stock, 1930/50	704	8	6			
(Estimated present value of Investments, £17251 11s. 0d.)				21001	19	11
" Sundry Debtors :—						
Advertising Account	103	16	6			
Less Commission accrued	11	5	2			
Messrs. Gurney & Jackson	92	11	4			
Telephone Deposit	700	6	2			
" Subscriptions in Arrear, £490. Estimated to realise	1	0	0			
" Amount paid on account of International Association of Chemical Societies						
" Insurance paid in advance						
" Cash at Bank	444	15	9			
" Cash in hand	4	3				
" Research Fund :—						
Investments (value when acquired) :						
£1000 North British Railway 4 per cent. No. 1 Preference Stock	1010	0	0			
£4400 Metropolitan Consolidated 3½ per cent. Stock	4587	18	0			
£1034 Great Western Railway 2½ per cent. Debenture Stock	1049	15	11			
£1142 16s. New South Wales 3 per cent. Stock	1000	0	0			
£1122 Metropolitan Water Board 3 per cent. "B" Stock	1002	16	9			
£1305 Midland Railway 2½ per cent. Debenture Stock	1010	0	9			
£806 Victoria 3 per cent. Stock	706	6	2			
(Estimated present value of Research Fund Investments, £9055 16s. 9d.)	10366	17	7			
" Cash at Bank... .. .	164	15	7			
	10531	13	2			
	£53386	12	3			

£53386 12 3

£53386 12 3

INCOME AND EXPENDITURE ACCOUNT

<i>Income.</i>		£	s.	d.	£	s.	d.
To Life Compositions					297	0	0
„ Admission Fees					640	0	0
„ Annual Subscriptions—							
Received in advance, on account of 1913		300	0	0			
„ during 1913		4463	0	0			
„ „ „ 1912		320	0	0			
„ „ „ 1911		12	0	0			
		5095	0	0			
Less amount included in last year's Income, being valuation of							
Arrears as per last Balance Sheet		350	0	0			
		4745	0	0			
Add Arrears at date: 1913, £456; 1912, £24; 1911 and previous, £10,							
estimated to realise as per Balance Sheet		360	0	0	5105	0	0
„ Lady Subscribers					4	10	0
„ Investments:—							
Dividends on £6730 Metropolitan Consolidated 3½ per cent. Stock ...		221	16	4			
„ £1050 London and North Western Railway 3 per cent.							
Debenture Stock		29	13	2			
„ £1520 14s. 3d. Cardiff Corporation 3 per cent. Stock ...		42	19	4			
„ £1400 India 2½ per cent. Stock		32	19	4			
„ £2400 Bristol Corporation 2½ per cent. Debenture Stock ...		56	10	0			
„ £4341 Midland Railway 2½ per cent. Preference Stock ...		102	3	10			
„ £1200 Leeds Corporation 3 per cent. Stock		33	18	0			
„ £1500 Transvaal 3 per cent. Guaranteed Stock, 1923/53 ...		42	7	6			
„ £1200 North British Railway 3 per cent. Debenture							
Stock		33	18	0			
„ £700 Canada 3½ per cent. Stock 1930/50		23	1	6			
„ Income Tax Recovered		36	12	4			
„ Interest on Deposit Account		26	15	1	682	14	5
„ Publication Sales:—							
Journals		1048	4	4			
Proceedings		45	3	5			
Collective Index, Vols. I—IV		89	17	3			
Do. Vol. V		1071	17	6			
Library Catalogue		17	6				
Atomic Weight Tables		7	8				
Jubilee Volumes		11	0				
Annual Reports on Progress of Chemistry		175	4	0			
		2382	2	8			
Less Publishers' Commission		154	13	1	2227	4	7
„ Proceeds of Advertisements in Journal		£261	16	6			
Less Commission		23	16	2	238	0	4
„ Miscellaneous Receipts					2	2	3
„ Honorarium for Publication of Annual Reports in French					5	0	0
„ Subscriptions from other Societies					34	2	6
„ Balance, being Excess of Expenditure over Income carried to Balance							
Sheet					237	7	7
					£9473	1	8

I have examined the above Accounts with the Books and Vouchers of the Society, and the Investments.

23, QUEEN VICTORIA STREET, E.C.
March 2nd, 1911.

W. B. KEEN,
Chartered Accountant.

FOR THE YEAR ENDED 31ST DECEMBER, 1913.

Expenditure.

	£	s. d.	£	s. d.
By Expenses on account of Journal and Proceedings:—				
Salary of Editor, including Indexing	570	0 0		
Salary of Sub-Editor	200	0 0		
Editorial Postages	13	10 0		
Abstractors' Fees	609	7 9		
Printing of Journal	3016	19 3		
Banding	55	2 3		
Printing of Advertisements	66	16 9		
Wrappers and Addressing	117	10 7		
Distribution of Journal	628	0 5		
Authors' Copies	190	17 6		
Insurance of Stock	5	4 0		
Printing of Proceedings	243	16 10		
Banding	8	12 4		
Distribution	44	0 7		
Decennial Index Printing	1378	0 0		
„ Distribution	33	17 2		
	1411	17 2		
			7181	15 5
„ Annual Reports on the Progress of Chemistry			466	6 4
„ Purchase of back numbers of Journal			3	3 6
„ List of Fellows			75	2 3
„ Library Expenses:—				
Salary of Librarian and Assistant	204	16 0		
Books and Periodicals	231	19 0		
Binding	33	3 7		
Bookcases	155	13 0		
			680	11 7
„ Indexing for International Catalogue			30	0 0
„ Donation to International Commission of Publication of Annual Tables of Constants and Numerical Data, Chemical, Physical and Techno- logical			10	0 0
„ Administrative Expenses:—				
Salary of Staff	354	4 0		
Wages (Commissionaire, Housekeeper, and Charwoman)	157	4 9		
Coal and Lighting	31	12 5		
House Expenses and Repairs	70	8 10		
Furniture	38	3 10		
Tea Expenses	31	14 5		
Insurances	11	9 9		
Accountants' Charges	21	0 0		
Commission on Recovery of Income Tax	1	16 6		
Printing	126	3 7		
Stationery	45	14 11		
Postages	134	13 4		
Dinner Expenses	13	17 6		
Miscellaneous Expenses	37	18 9		
			1076	2 7

£9473 1 8

certify them to be in accordance therewith. I have also verified the Balance at the Bankers

Approved—SAMUEL RIDEAL,
JAMES J. DOBBIE,
ALEXANDER PEDLER.

the Fund endowed by M. Ernest Solvay to which reference has already been made.

The net income of the Research Fund from investments is about £343, and to this was added £77 16s. 3d., being unexpended grants from previous years which were returned. From this, grants amounting in all to £368 were made, leaving £50 to be added to the balance in hand.

A vote of thanks to the Treasurer, Secretaries, Foreign Secretary, and Council for their services during the past year was proposed by Dr. BERNARD DYER, seconded by Dr. L. T. THORNE, and acknowledged by Sir WILLIAM RAMSAY.

The PRESIDENT then delivered his address, entitled "Tautomerism." A vote of thanks to the President, coupled with the request that he would allow his address to be printed in the Transactions, was proposed by Professor R. MELDOLA, seconded by Professor W. JACKSON POPE, and carried with acclamation, the PRESIDENT making acknowledgment.

The Report of the Scrutators was presented, and the PRESIDENT declared that the following had been elected as Officers and Council for the ensuing year:

President.—William Henry Perkin, Sc.D., LL.D., F.R.S.

Vice-Presidents who have filled the Office of President.—Henry Edward Armstrong, Ph.D., LL.D., F.R.S.; Alexander Crum Brown, D.Sc., LL.D., F.R.S.; Sir William Crookes, O.M., D.Sc., F.R.S.; Sir James Dewar, M.A., LL.D., F.R.S.; Harold Bailly Dixon, M.A., Ph.D., F.R.S.; Percy Faraday Frankland, Ph.D., LL.D., F.R.S.; Augustus George Vernon Harcourt, M.A., D.C.L., F.R.S.; Raphael Meldola, D.Sc., LL.D., F.R.S.; Hugo Müller, Ph.D., LL.D., F.R.S.; William Odling, M.A., M.B., F.R.S.; Sir William Ramsay, K.C.B., LL.D., F.R.S.; James Emerson Reynolds, Sc.D., M.D., F.R.S.; The Rt. Hon. Sir Henry Enfield Roscoe, LL.D., F.R.S.; Sir Edward Thorpe, C.B., LL.D., F.R.S.; Sir William Augustus Tilden, D.Sc., F.R.S.

Vice-Presidents.—Herbert Brereton Baker, M.A., D.Sc., F.R.S.; Peter Phillips Bedson, M.A., D.Sc.; Horace Tabberer Brown, LL.D., F.R.S.; Charles Thomas Heycock, M.A., F.R.S.; Edmund James Mills, D.Sc., LL.D., F.R.S.; Gilbert Thomas Morgan, D.Sc.

Treasurer.—Alexander Scott, M.A., D.Sc., F.R.S.

Secretaries.—Samuel Smiles, D.Sc.; James Charles Philip, M.A., D.Sc., Ph.D.

Foreign Secretary.—Arthur William Crossley, D.Sc., Ph.D., F.R.S.

Ordinary Members of Council.—George Barger, M.A., D.Sc.; The Rt. Hon. the Earl of Berkeley, F.R.S.; Edward John Bevan; Adrian John Brown, M.Sc., F.R.S.; Harold Govett Colman, D.Sc., Ph.D.; Arthur Harden, D.Sc., Ph.D., F.R.S.; Thomas Martin Lowry, D.Sc.; Kennedy Joseph Previt   Orton, M.A., Ph.D.; Robert Henry Aders Plimmer, D.Sc.; Edward John Russell, D.Sc.; George Senter, D.Sc.; John Millar Thomson, LL.D., F.R.S.

Thursday, April 2nd, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the chair.

The PRESIDENT announced that the Council have appointed the following Committees for the year 1914—1915:

Finance Committee.—Messrs. E. G. Hooper, G. T. Moody, Sir Edward Thorpe, Sir William A. Tilden, and the Officers.

House Committee.—Messrs. Horace T. Brown, R. Messel, J. E. Reynolds, J. M. Thomson, Sir William A. Tilden, and the Officers.

Library Committee.—Messrs. B. Dyer, W. Gowland, A. Harden, J. T. Hewitt, C. A. Keane, A. R. Ling, T. M. Lowry, R. Meldola, E. J. Mills, J. M. Thomson (Chairman), Sir William A. Tilden, J. A. Voelcker, the Editor, and the Officers.

Publication Committee.—Messrs. H. B. Baker, J. N. Collie, F. G. Donnan, B. Dyer, M. O. Forster, T. M. Lowry, F. B. Power, G. Senter, and the Officers.

Research Fund Committee.—Messrs. H. B. Baker, W. R. Bousfield, Horace T. Brown, H. B. Dixon, J. J. Dobbie, F. G. Donnan, M. O. Forster, P. F. Frankland, W. J. Pope, W. Palmer Wynne, and the Officers.

Messrs. S. Bate, A. H. Hay, and F. A. Pickworth were formally admitted Fellows of the Society.

Certificates were read for the first time in favour of Messrs.:

Nicholas Alexander Aufilogoff, c/o The London and Thames Haven Oil Wharves, Ltd., Thames Haven, Essex.

Harry Berry, The Northern College of Pharmacy, Burlington Street, Manchester.

Stanley Winter Collins, B.Sc., 1, Tideswell Road, Putney, S.W.
 Herbert William Cremer, B.Sc., Preston Lea, Faversham.
 Leonard Eric Hinkel, B.Sc., Bucklands, Old Oak Road, Acton,
 W.

John Orron Leighton, 30, Albany Street, Hull.

Ernest Ferguson Pollock, Ph.D., Kirkland, Bonhill, Dumbarton-
 shire.

Charles Edward Roberts, B.A., B.Sc., St. John's College, Cam-
 bridge.

Certificates have been authorised by the Council for presentation
 to ballot under Bye-Law I (3) in favour of Messrs.:

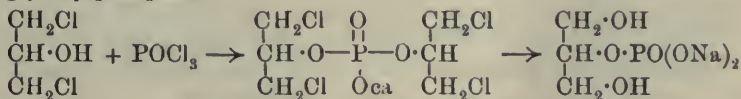
Edward Godfrey Bryant, B.A., B.Sc., Grey Institute, Port
 Elizabeth, S. Africa.

Alfred Cornwell Harrison, Penhalonga, Rhodesia, S. Africa.

Of the following papers, those marked * were read:

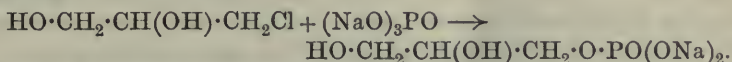
- *92. "The constitution of the glycerylphosphates. The synthesis
 of α - and β -glycerylphosphates." By Harold King and Frank
 Lee Pyman.

Pure salts of α - and β -glycerylphosphoric acids have been pre-
 pared. For the preparation of the β -salts, α -dichlorohydrin was
 combined with phosphoryl chloride (compare Tutin and Hann,
 T., 1906, 89, 1749), giving *calcium bis-s-dichloroisopropylphosphate*,
 which on hydrolysis with sodium carbonate yielded sodium
 β -glycerylphosphate,



This salt was identical with Poulenc's crystalline sodium glyceryl-
 phosphate of commerce, which must consequently be the β -salt.
 The identity of the two salts was confirmed by the comparison of
 the properties of the calcium, barium, brucine, and quinine salts
 prepared from each of them.

An attempt to prepare the α -salts in an analogous manner was
 unsuccessful, but these salts were readily obtained by the action
 of α -monochlorohydrin on trisodium phosphate in cold aqueous
 solution:



Several salts of the α -acid were prepared and characterised.

The results of previous investigators were discussed.

DISCUSSION.

Dr. PLIMMER asked Dr. Pyman how the analyses of the glyceryl-phosphates, which he described, had been effected. In his experience of the analysis of organic phosphorus compounds, the values obtained for carbon, by combustion by both dry and wet methods, were always too low.

***93. "The viscosity of sulphuric acid."**

By Albert Ernest Dunstan.

Some years ago (Dunstan and Wilson, T., 1907, **91**, 85) a series of determinations of the viscosities of aqueous sulphuric acid solutions at 25° was undertaken with the object of finding the maximum point. Owing to the kindness of Prof. A. F. Joseph, it was discovered that a constant numerical error had been made in calculating the values of the viscosity-coefficients. Consequently, the numbers given on p. 85 of the above reference should be multiplied by 0.2325.

In the meantime, several papers have appeared on the viscosity of sulphuric acid, and as the results apparently fall on two distinct curves, it was thought desirable to repeat some of the measurements, both at 25° and at other temperatures, and to ascertain which of these two sets of results is the more accurate.

The figures up to date are as follows:

Viscosity.	Tempera- ture.	Observer.	Reference.
0.618	0.0°	Kremann and Ehrlich	<i>Monatsh.</i> , 1907, 28, 831.
0.4843	0.0	Drucker and Kassel	<i>Zeitsch. physikal. Chem.</i> , 1911, 76, 373.
0.3195	11.2	Poiseuille	<i>Ann. Chim. Phys.</i> , 1843, [ii], 7, 50.
0.2694	15.0	Drucker and Kassel	<i>loc. cit.</i>
0.2193	20.0	Graham	<i>Phil. Mag</i> , 1862, 24, 238.
0.1915	25.0	Bergius	<i>Zeitsch. physikal. Chem.</i> , 1910, 72, 357.
0.210	30.0	Pound	T., 1911, 99, 708.
0.172	33.0	Kremann	<i>loc. cit.</i>
0.076	63.5	Kremann	<i>loc. cit.</i>
0.0503	76.5	Drucker	<i>loc. cit.</i>

The values found by Kremaun and Ehrlich and by Pound lie well above those of Drucker, Graham and Poiseuille.

In the experiments here recorded, the strength of the sulphuric acid was determined by gravimetric and volumetric methods, and also by means of the densities of its diluted aqueous solutions.

The mean of eight concordant analyses was 100.3 per cent. (calculated as H₂SO₄), with a mean error of 0.2 per cent.

The method which was adopted for obtaining values of the viscosity of the 100 per cent. acid consisted in interpolating on a viscosity-concentration curve ranging from 96 to 100.3 per cent.

The results are as follows:

Tempera- ture.	Viscosity of			
	100.3 per cent. H_2SO_4 .	99.8 per cent. H_2SO_4 .	98.2 per cent. H_2SO_4 .	96 per cent. H_2SO_4 .
13.8°	0.371	0.342	—	—
25.0	0.239	0.224	0.220	0.190
50.0	0.109	0.102	0.0954	0.0943
70.0	0.0632	0.0657	0.0598	—
90.0	0.0433	0.0410	0.0403	0.0399

whence for the 100 per cent. acid:

Temperature.	Viscosity.
13.8°	0.360
25.0	0.235
50.0	0.106
70.0	0.0635
90.0	0.0425

The value thus found at 25° is rather less than that which was previously obtained, but it will be seen that the new values agree excellently with those of Kremann.

*94. "Tautomerism, desmotropy, and dynamic isomerism."

By Thomas Martin Lowry.

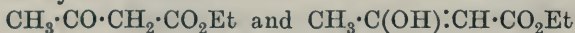
The question asked by Prof. Meldola at the close of the President's Address to the Annual General Meeting of the Chemical Society suggests that a short statement in reference to the nomenclature of the subject might be welcomed by some Fellows who have not had an opportunity of consulting the earlier literature.

Briefly, it may be said that all the essential facts in reference to the conception of *equilibrium between isomerides*, as described so lucidly by the President in his Address, are set out in Butlerow's classical, but almost forgotten, paper, "Ueber Isodibutylen" (*Annalen*, 1877, **189**, 44). They were applied by him to explain the behaviour of substances such as cyanic and hydrocyanic acids, which yield two series of derivatives; these were regarded by Butlerow as mixtures of isomerides in equilibrium, to which no definite formula could be assigned, "since molecules of two or more isomeric varieties would always be present." The name *dynamic isomerism* was introduced in 1899 (T., **75**, 235), as a paraphrase of Butlerow's description of "a condition of equilibrium depending on incessant isomeric change"; but the adjective *isodynamic* had already been suggested by Armstrong in 1889 (Watt's Dictionary, "Isomerism") to describe those isomerides "which change their

type with exceptional facility in the course of chemical interchanges." The word *metameric* had been used in this sense in 1833 by Berzelius to describe isomerides which were readily converted into one another, but the usefulness of the word was destroyed by a misguided attempt to transfer it to another usage.

The hypothesis of *tautomerism* was introduced by Laar in 1885 (*Ber.*, 18, 648) to account for the facts which had already (as time has shown) been explained adequately by Butlerow. The clearest statement of what tautomerism means, however, is found in a subsequent paper (*Ber.*, 1886, 19, 730), in which Laar sets out the points in which his views differ from those of Butlerow. Laar asserts that, in every case of tautomerism, the different formulæ suggested by the reactions of the substance represent, "not isomeric, but identical bodies"; the term cannot, therefore, be applied to any case of isomerism, however readily the isomerides may be converted into one another. Further, he repudiates the chemical analogy of dissociation, which Butlerow had suggested, and quotes, instead, the views of Maxwell and of Wiedemann on the molecular vibrations which give rise to light.

It is impossible to say whether tautomerism exists; but it has at least been proved by the work of Knorr that the two substances represented by the formulæ



are not tautomeric, but have a real existence as well-defined isomeric compounds, which only change into one another under definite physical and chemical conditions. They have, in fact, a right to be described as isomerides, in just the same sense as ammonium cyanate and carbamide, two fortunate compounds which have hitherto escaped condemnation, although equally guilty of undergoing reversible isomeric change and of yielding two series of derivatives.

The word *desmotropy* was introduced by Jacobson (*Ber.*, 1887, 20, 1732, footnote; 1888, 21, 2628, footnote) in 1887, when it had become evident that Laar's theory of tautomerism had broken down completely in the very case to which it had been most frequently applied, namely, the labile isomerism which results from the contiguity of a double bond and an acidic hydrogen atom. Jacobson adopted the view "that the known forms of such compounds are to be represented by a definite grouping of atoms, which in certain reactions passes over into an isomeric grouping by a rearrangement of bonds consequent upon the displacement of a hydrogen atom"; it was to express this view that the word "desmotropy" was introduced. If used in this sense, to describe the labile isomerism produced by the mobility of a hydrogen atom, it might be of real

value; unfortunately, the meaning of the word was tampered with by Hantzsch and Hermann (*Ber.*, 1887, **20**, 2802), and, as an inevitable consequence, it has become ambiguous, and has ceased to be clearly significant.

DISCUSSION.

Dr. FORSTER expressed regret that Dr. Lowry's remarks failed to clear up the confusion attending the words in question. Having stated that no case of genuine tautomerism exists, and that he deplored the association of an incorrect meaning with any word, Dr. Lowry might have declared that, in his opinion, use of this word should be discontinued. In Dr. Forster's view, the word isodynamic was unsuitable, because it suggested equal, or similar, force or motion, whereas one of the commonest features of such pairs is that one member changes far more rapidly than the other.

Dr. LOWRY replied that the word "tautomeric" should be withdrawn in all cases of proved isomerism, and might with advantage be abandoned altogether by those who no longer accepted Laar's hypothesis. The familiar words "isomerism" and "isomeric change" should be used whenever they expressed the essential facts; if these were not sufficient, the term "dynamic isomerism" might be used to distinguish the more labile varieties of isomerism; in view of the difficulty of re-introducing the word "metameric" in its original sense, the labile compounds themselves were best described as "isodynamic," for example, the two substances isolated by Knorr could be referred to as "isodynamic forms" of the ester.

95. "The system: ethyl ether-water-potassium iodide-mercuric iodide. Part III. Solutions unsaturated with respect to solid phases in the four-component system." By Alfred Charles Dunningham.

Liquids unsaturated with respect to solid phases can exist either as one, two, or three layers.

Curves have been determined experimentally for the series of three conjugate liquids, and from these the nature of the equilibria underlying the formation of three layers has been deduced.

The conditions under which two and three layers can separate in the system were fully discussed.

96. "The velocity of saponification of the acyl derivatives of the substituted phenols. Part I. Phenyl benzoate." By Hamilton McCombie and Harold Archibald Scarborough.

The velocity of saponification of phenyl benzoate by alcoholic potassium hydroxide at 30° has been studied with reference to the

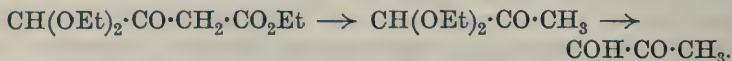
influence of the initial concentration of both the ester and the alkali.

The value of K was found to be independent of the initial concentration of either of the reacting substances, a mean value, $K=0.00428$, being obtained as the result of five series of determinations, each series representing twenty-five readings.

The reaction, as a whole, was found to be bimolecular; the van't Hoff and Noyes equations for determining the order of the reaction proved that the reaction was unimolecular with regard to the initial concentration of the ester or the alcoholic potassium hydroxide.

97. "A general method for the preparation of glyoxals and their acetals." By Henry Drysdale Dakin and Harold Ward Dudley.

Ethyl diethoxyacetate and ethyl acetate react smoothly with sodium to give ethyl γ -diethoxyacetoacetate. The latter substance on hydrolysis with potassium hydroxide gives the acetal of methylglyoxal. Methylglyoxal is obtained from the acetal by hydrolysis with dilute sulphuric acid.



Ethyl γ -diethoxyacetoacetate readily yields mono- and di-alkyl derivatives on successive treatment with sodium and alkyl haloids, thus furnishing a convenient method for the preparation of new substituted γ -diethoxyacetoacetic esters, alkylglyoxals, and their corresponding acetals. The following substances have been prepared:

Ethyl γ -diethoxy- α -methylacetoacetate, *ethylglyoxal* and its acetal; *ethyl γ -diethoxy- $\alpha\alpha$ -dimethylacetoacetate*, *isopropylglyoxal* and its acetal; *ethyl γ -diethoxy- α -methyl- α -ethylacetoacetate*, *sec.-butylglyoxal* and its acetal; *ethyl γ -diethoxy- α -isopropylacetoacetate*; *isobutylglyoxal* and its acetal; *ethyl γ -diethoxy- α -benzylacetoacetate*, *phenylethylglyoxal* and its acetal.

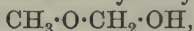
The reactions of ethyl γ -diethoxyacetoacetate are still under investigation.

98. "The action of sulphuric acid on paraformaldehyde."

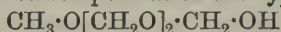
By John Gunning Moore Dunlop.

When paraformaldehyde is heated for twenty-four hours in a sealed tube with a little sulphuric acid at $115-120^\circ$, the contents are converted into a liquid, which on distillation gives two frac-

tions. One of these is methyl formate, and the other, which boils at 90—100°, is found to contain hydroxymethyl ether,



and somewhat indefinite compounds of the type



(compare Reychler, *Bull. Soc. chim.*, 1907, [iv], 1, 1189).

Since the paraformaldehyde was shown to be free from methyl alcohol, the latter must have resulted from the decomposition of the methyl formate, which in turn is derived from the condensation of two molecules of formaldehyde.

99. "The destructive distillation of soil." (Preliminary note.)

By Eric John Holmyard.

With a view to obtain further insight into the nature of the organic matter in soil, various soils have been destructively distilled from an iron retort. At a temperature of low redness, a distillate of two layers was obtained; the lower, aqueous, layer was strongly alkaline, and smelt of ammonia. The upper layer consisted of small quantities of a brown oil, possessing a characteristic odour resembling that of pyridine. Qualitative tests on the aqueous layer showed the presence of phenol and ammonia. The oil, after the addition of alkali, was purified by distillation in a current of steam, and was then pale yellow. On exposure to air for some days it darkened. Qualitative tests indicated the presence in it of pyridine, quinoline, pyrrole, indole, thiophen, and possibly furfuraldehyde.

Both field soils and garden soils gave similar results, although the yield of oil was greater in the case of the garden soils.

The results are consistent with the view that the processes of decomposition occurring in the organic matter in soil are similar to those operative in the formation of coal. Further experiments on the subject are in progress.

100. "Dibenzoylglucoxylose, a natural benzoyl derivative of a new disaccharide." By Frederick Belding Power and Arthur Henry Salway.

The crystalline compound *dibenzoylglucoxylose* (m. p. 147—148°), $\text{C}_{11}\text{H}_{18}\text{O}_{10}(\text{CO}\cdot\text{C}_6\text{H}_5)_2\cdot\text{H}_2\text{O}$, which represents the bitter constituent of the leaves and stems of *Daviesia latifolia*, R. Br. (T., 1914, 105, 772), has now been completely examined with respect to its properties, and those of the disaccharide (*glucoxylose*) which it yields by its primary hydrolysis.

101. "The molecular weights of some salts of the alkali metals and an account of the compounds of these salts with the alcohols."
By William Ernest Stephen Turner and Crellyn Colgrave Bissett.

The results of an investigation (shortly to be published) on the influence of the solvent on the molecular weights of salts (Turner and Pollard) have been applied to interpret the behaviour in solution of the salts of the alkali metals, more particularly those with the halogen elements, and it was argued that the non-associated state of these salts found by several previous workers could be satisfactorily accounted for by the influence either of the dielectric character of the solvent or of the temperature of the determination.

In the series of alcohols—ethyl, *isobutyl* and *isoamyl*—it was demonstrated that the molecular weights of lithium chloride, bromide, iodide, and nitrate rise as the dielectric constant of the solvent falls. The complication arising through the combination of solvent and solute was discussed, and the five possible types of behaviour owing to concurrent association and chemical combination were illustrated. Association is most pronounced with lithium nitrate, which does not enter into combination with the solvents employed. The associated character of the lithium salts was demonstrated further by molecular-weight determinations in acetic acid.

The lithium haloids combine with the alcohols to form compounds $\text{LiCl}(\text{Br}, \text{I})_3\text{MeOH}$ and $\text{LiCl}(\text{Br}, \text{I})_4\text{ROH}$, where R may be the ethyl, *n*-propyl, *isobutyl*, or *isoamyl* radicle. The compounds NaI_3MeOH and $\text{NaI}_3\text{CH}_3\cdot\text{CO}_2\text{H}$ were also isolated.

102. "Consistent molecular formulæ."
By William Ernest Stephen Turner.

From the point of view of Avogadro's hypothesis, it was argued that many of the common molecular formulæ still in use, such, for example, as H_2 , I_2 , P_4 , SnCl_2 , and $\text{C}_2\text{H}_4\text{O}_2$, cannot be regarded as derived consistently, nor can they, as the outcome of modern work, be considered as adequate.

When molecular weights are derived from measurements in solution, an additional factor is introduced in the effect of the solvent, rendering a complete comparison with vapour-density determinations impossible. The conditions to be observed in order to make the comparison as favourable as possible were discussed.

It was argued that the molecular weight of a substance is, in

most cases at any rate, a property dependent on temperature, pressure, and the medium, just as any other physical property, and that, in consequence, the only satisfactory mode of writing molecular formulæ is by a formula X_n , in the case of elements, or $(XY)_n$ for compounds, where n is to be given the value which holds for the particular conditions of existence.

For some substances, n remains constant over a wide range. Thus, for hydrogen, $n=2$ over a wide range of conditions, but at a very high temperature may become 1. For sulphur, this variation extends from $n=8$ to $n=1$.

The use of molecular formulæ in the way advocated would emphasise the connexion between the chemical and physical properties and the molecular weight.

103. "Note on the formation of triphenylcarbinol."

By Maurice Copisarow.

Friedel and Crafts (*Compt. rend.*, 1877, **84**, 1452; *Ann. Chim. Phys.*, 1884, [vi], **1**, 500) found that on distilling the condensation product obtained from carbon tetrachloride and benzene in the presence of aluminium chloride triphenylmethane was chiefly produced, along with some triphenylcarbinol and possibly tetraphenylmethane.

E. and O. Fischer (*Annalen*, 1878, **194**, 254), repeating Friedel and Crafts' experiment in the same manner, obtained chiefly triphenylmethane, and a little triphenylcarbinol, but failed to detect any tetraphenylmethane.

Hinsberg (*Ber.*, 1899, **32**, 2422), replacing aluminium chloride by ferric chloride in the condensation of carbon tetrachloride with benzene, found the product, on distillation in a current of steam, to consist of triphenylcarbinol only.

The question arises whether the difference in the products is due to the dissimilar experimental conditions or to the different effect of the metallic chlorides. In order to decide this, the author has performed the following experiments:

(1) Sixteen grams (1 mol.) of carbon tetrachloride were mixed with 25—30 grams (3—4 mols.) of benzene, and 250 c.c. of carbon disulphide added; 45 grams of aluminium chloride were gradually introduced, the reaction being allowed to cease after each portion before further addition. The mixture was heated on the steam-bath for about nine hours, and afterwards decomposed with ice and hydrochloric acid, the carbon disulphide removed, and the product subjected to distillation with steam. The residue, a dark solid mass, was dissolved in alcohol, from which triphenylcarbinol crystal-

lised; the latter was dissolved in benzene, the solution boiled with animal charcoal, and filtered, when, on cooling, large, white, rhombic crystals of triphenylcarbinol, melting at 159° , were obtained. The yield was 19 grams.

(2) Hinsberg's experiment (*loc. cit.*) was repeated, but the product was submitted to distillation as described by Friedel and Crafts. The product was found to consist chiefly of triphenylmethane (m. p. 92°), and a small amount of triphenylcarbinol.

From these experiments the conclusion may be drawn that aluminium chloride is identical in its effect with ferric chloride, but being more energetic it is to be preferred, as it gives better yields and requires less time to complete the reaction.

The real difficulty in obtaining very good yields is in the large amount of tarry matter formed during the reaction.

The difference in the products obtained by Friedel and Crafts and E. and O. Fischer on the one hand, and by Hinsberg on the other is due to the secondary effect during the distillation without steam in the former case.

No tetraphenylmethane was detected in the author's experiments.

104. "The ionisation of acids and their activity as catalysts."

By Harry Medforth Dawson.

Recent experiments (Dawson and Powis, T., 1913, 103, 2135) have shown that the rate of isomeric change of acetone in dilute aqueous solution under the catalytic influence of acids can be represented by the equation $v = k_H ca + k_M c(1 - \alpha)$, in which v is the reaction velocity, c the concentration of the acid, α its degree of ionisation, and k_H and k_M are the activity-coefficients for the ionised and non-ionised acids respectively. For hydrochloric acid, the degree of ionisation employed in the calculation was that yielded by conductivity data, whilst for dichloroacetic, $\alpha\beta$ -dibromopropionic, chloroacetic, and acetic acid the value of α was calculated from the ionisation-coefficient, $K = \alpha^2 / (1 - \alpha)$.

According to Wegscheider (*Zeitsch. physikal. Chem.*, 1909, 69, 603), the mass-action equation is no longer satisfied by the conductivity data if the ionic concentration exceeds a certain limiting value. Empirical formulæ connecting the degree of ionisation and the concentration have been suggested by Kraus and Bray (*J. Amer. Chem. Soc.*, 1913, 35, 1315) and by Kendall (T., 1912, 101, 1275), which take into account the inter-ionic action which is supposed to give rise to the increase of $\alpha^2 / (1 - \alpha)$ in solutions of higher concentration.

Assuming that the deviations from the mass law which are

indicated by these empirical equations are true deviations, it is somewhat surprising to find such a close agreement between the observed and calculated reaction velocities when the value used for the degree of ionisation is that calculated on the basis of the mass law.

According to Kendall (*loc. cit.*, p. 1295), the ionisation of dichloroacetic acid can be represented by the formula

$$c\beta^2/(1-\beta)=0.0316+0.080(1-\beta)/\beta,$$

where β is the degree of ionisation at concentration c . If the values of β given by this formula are substituted in the equation $v=k_Hc\beta+k_Mc(1-\beta)$, the combination of the two extreme solutions ($c=0.01$ and 0.2) gives $k_H=462$ and $k_M=126$, whereas the α values derived from the mass-action formula yield $k_H=445$ and $k_M=203$. Both pairs of coefficients give almost equally good results in so far as the agreement between the observed and calculated velocities for acid solutions of intermediate concentration is concerned. This is shown in the following table, in which the first column gives the concentration of the acid, the second and third the values of α and β , the fourth and fifth the corresponding calculated velocities v_α and v_β , and the sixth the observed velocity, v .

Dichloroacetic Acid.

c .	α .	β .	v_α .	v_β .	v .
0.01	0.856	0.845	(4.10)	(4.10)	4.10
0.02	0.769	0.778	7.79	7.75	7.95
0.05	0.621	0.675	17.7	17.65	18.1
0.1	0.503	0.593	32.5	32.5	32.7
0.2	0.393	0.512	(59.6)	(59.6)	59.6

According to the results in this table, there is nothing to choose between the α and β values for the degree of ionisation. It should be noted, however, that the reaction velocities under v_β are calculated on the basis of a coefficient $k_H=462$, which deviates appreciably from the coefficient $k_H=437$ derived from the data for hydrochloric acid. The divergence is greater than that shown by any one of the k_H values which are obtained from the data for the four weaker acids on the assumption that the ionisation occurs in accordance with the mass law. The agreement between the separate values of k_H (*loc. cit.*, p. 2142) is the more remarkable when the difference in the ionic concentration of the solutions used is taken into account.

From the above comparison, it is evident that the degree of ionisation of acids in relatively concentrated solutions must be determined with greater precision before it is possible to assign final values to the activity-coefficients of the non-ionised acids. Experiments with this object in view are in progress.

105. "Synthesis of *dl*-tyrosine and *dl*-3:4-dihydroxyphenylalanine."
By Henry Stephen and Charles Weizmann.

In continuation of previous work (P., 1912, **28**, 147), the authors have obtained the following new substances, in addition to those already mentioned in the above note:

Phthalamino-p-methoxybenzylmalonic acid, obtained by hydrolysing ethyl phthalimino-*p*-methoxybenzylmalonate, is a white powder crystallising from acetic acid in plates, and melting and decomposing at 210°.

Phthalaminopiperonylmalonic acid, obtained from the corresponding condensation product, melts and decomposes at 234°. On hydrolysis with hydrochloric or hydrobromic acid, the *hydrochloride* (m. p. 246°) or *hydrobromide* (m. p. 212°) of 3:4-dihydroxyphenylalanine is obtained.

106. "Optically active derivatives of *d*-dimethoxy- and *d*-diethoxy-succinic acids." By Charles Robert Young.

The preparation of methyl *d*-diethoxysuccinate was described; the specific rotation of the pure liquid was found to be almost identical with that of the isomeric ethyl *d*-dimethoxysuccinate.

The optically active anilic acids, anils, anilides, and hydrazides derived from *d*-dimethoxy- and *d*-diethoxy-succinic acids have been prepared, and their rotatory powers compared. No evidence of the formation of *isoanils* was obtained.

d-Dimethoxysuccinamic acid and the corresponding imide were also prepared, and the latter was converted into its methyl derivative by alkylation with silver oxide and methyl iodide.

107. "Rate of evolution of gases from supersaturated solutions. Part II. Carbon dioxide in solutions of gelatin and starch."
By Alexander Findlay and George King.

In continuation of the previous investigation (T., 1913, **103**, 1170), it was shown that the rate of escape of carbon dioxide from solutions of gelatin and of starch is markedly affected, and more especially so in the case of dilute solutions, by the method of treatment of the solution. The shorter the time during which the solutions are boiled (to remove air), and the more rapid the cooling of the boiled solutions, the greater is the influence of the colloidal solution on the rate of escape of gas. The results obtained, more especially in the case of solutions of gelatin, lead to the conclusion that the difference in the behaviour of such solutions, as compared with water, is due, mainly, to the concentration of the gelatin *sol*, and not to the presence of the gel.

108. "The oxidation of carbohydrates and related substances by means of potassium persulphate." By John Kerfoot Wood and Nellie Walker.

The authors have made a comparative study of the rates of oxidation of a number of carbohydrates and kindred substances by potassium persulphate in the presence of silver sulphate. In the absence of the silver salt the reaction proceeds very slowly, but the addition of small quantities of a 0.5 per cent. solution of silver sulphate produces a marked acceleration of the process of oxidation. The experiments were conducted at 25°, and the solution of persulphate was almost saturated at that temperature. Equivalent amounts of the carbohydrates were employed, and sufficient of the persulphate solution to supply one atom of oxygen per molecule of carbohydrate was added. (With disaccharides, one atom of available oxygen per half molecule of sugar was added.) The reaction was followed by removing portions of the mixtures from time to time, and measuring the acidity of the solution. Velocity-constants were calculated by means of the bimolecular formula. The results show that galactose, arabinose, and xylose are all oxidised at about the same rate; the velocity of oxidation of dextrose is slightly lower than in the case of the three sugars mentioned, whilst the rate for rhamnose is a little lower than that for dextrose. The authors consider that in the case of these five sugars it is extremely probable that under the conditions employed the sugars are almost quantitatively converted into the corresponding aldonic acids.

The velocity of oxidation of *lævulose* is greater than that of dextrose, and the process does not appear to be of so simple a character.

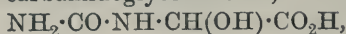
The disaccharides are oxidised more rapidly than the simple sugars.

With the polyhydric alcohols it was impossible to obtain, in the majority of cases, a definite velocity-constant. This indicates the occurrence of secondary reactions, the alcohol probably being partly converted into an aldehyde, which is then more rapidly oxidised than was the original substance.

109. "Allanturic acid." By Arthur Walsh Titherley and Noel Guilbert Stevenson Coppin.

The syrup described as allanturic acid in the literature, obtained by the decomposition of allantoin by hot aqueous nitric acid and by other means, has been shown by the authors to be a mixture

the composition of which is dependent on its origin, the essential constituents being carbamidoglycollic acid,



its lactam, glyoxalylcarbamide, $\begin{array}{c} \text{CO} \text{---} \text{NH} \\ | \qquad \qquad \qquad \\ \text{CH}(\text{OH}) \cdot \text{NH} \end{array} > \text{CO}$, and a very weak base, $\text{C}_3\text{H}_5\text{O}_2\text{N}_3$, may also be present.

The syrup obtained from allantoin and nitric acid by Pelouze, and later by Mulder, has been closely studied. On treatment with acetone, it falls to a white powder containing about 60 per cent. of glyoxalylcarbamide, the remainder being chiefly the compound $\text{C}_3\text{H}_5\text{O}_2\text{N}_3$, partly present as nitrate. Since the latter dissociates on dissolving in water, giving free nitric acid, the powder appears to possess pronounced acid properties, but the glyoxalylcarbamide component is itself only a pseudo-acid requiring about 40 per cent. of an equivalent of alkali to show a neutral point (indefinite) to phenolphthalein in dilute aqueous solution. The "glyoxalylcarbamide" of Medicus cannot, on account of its properties and mode of formation, be this lactam, and the present investigation throws no light on its nature.

Evidence bearing on the nature of "allanturic acid" has been obtained by a study of the decomposition of allantoic acid by nitric acid under varying conditions. At 0° or 15° with concentrated nitric acid, one molecule of carbamide is eliminated, and after concentration in a vacuum in the cold, a syrup or amorphous solid is obtained, consisting of glyoxalylcarbamide and the nitrate of a carboxylic acid, probably carbamidoglycollic acid,

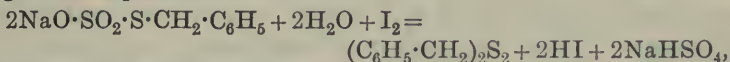


With aqueous nitric acid at 100° the decomposition is complete in a few minutes, but less than one molecule of carbamide is split off, and ammonia is eliminated. On now (1) concentrating in a vacuum and treating the syrup with acetone, impure glyoxalylcarbamide is obtained in small yield, but on (2) concentrating at 100° carbon dioxide is eliminated, and the syrup with acetone gives a relatively large yield of glyoxalylcarbamide admixed with the nitrate of the base, $\text{C}_3\text{H}_5\text{O}_2\text{N}_3$. These facts indicate that the allantoic acid decomposes in two ways, namely, (a) by hydrolysis, yielding carbamide and carbamidoglycollic acid, which during concentration suffers incomplete conversion into glyoxalylcarbamide; (b) by elimination of ammonia, yielding 4:6-diketohexahydro-1:3:5-triazine-2-carboxylic acid, which at 100° in the presence of nitric acid loses carbon dioxide, and furnishes 4:6-diketohexahydro-1:3:5-triazine (the weak base $\text{C}_3\text{H}_5\text{O}_2\text{N}_3$).

110. "The reaction between sodium benzylthiosulphate and iodine."

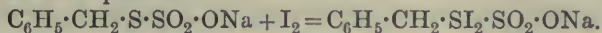
By Thomas Slater Price and Arthur Jaques.

The velocity of the reaction between sodium benzylthiosulphate and iodine in potassium iodide solution, which takes place according to the equation:



has been investigated in aqueous solution at 25°. Experiments with either component in excess showed that the reaction is unimolecular, both with respect to the sodium benzylthiosulphate and with respect to the free iodine; apparently the tri-iodide ion does not enter into reaction. When the components are present in equivalent concentrations, the velocity-constants are satisfactory in the more concentrated solutions, but rise continuously in the more dilute solutions; moreover, the value of the constants varies in the different solutions. The rise and variation in the constants were discussed and shown to be due, in all probability, (1) to the catalytic influence of the precipitated benzyl disulphide, owing to adsorption of iodine; (2) to the fact that the anion of the sodium benzylthiosulphate is alone concerned in the reaction.

The first stage in the reaction is probably the combination of a molecule of sodium benzylthiosulphate with one of iodine, in accordance with the equation:



The compound thus produced is then decomposed very quickly, with the formation of benzyl disulphide, sodium hydrogen sulphate and hydriodic acid.

111. "The dynamics of the action of halogens on aliphatic aldehydes. Keto-enol isomerism of the aldehydes." By Harry Medforth Dawson, Donald Burton, and Harry Ark.

Kinetic experiments relating to the action of bromine and iodine on acetaldehyde and its homologues have been made in dilute aqueous (or aqueous-alcoholic) solution, in which the rate of disappearance of the halogen was measured. The majority of the observations were made with acetaldehyde, and in all cases the aldehyde was present in relatively large quantity compared with the halogen.

The results obtained indicate that oxidation and substitution may both occur in the action of bromine on the aldehydes in dilute aqueous solution. Whereas in neutral solution the whole of the bromine is used up in the oxidation of the aldehyde, substitution

takes place simultaneously if the solution is rendered strongly acid by the addition of a mineral acid. The relation between the quantities of bromine, which are used up in oxidation and substitution respectively, depends on the concentration of the free bromine and on the acidity of the solution. In a *N*-hydrobromic acid solution the concentration of free bromine is only about one-twentieth of the total bromine-concentration as a consequence of the formation of polybromide (HBr_3), and in these circumstances it was found that the substitution reaction is the predominant reaction, whereas oxidation is predominant in a *N*-hydrochloric acid, and still more so in a *N*-sulphuric acid solution.

In neutral solution, iodine reacts with acetaldehyde very slowly, but the rate of disappearance of the halogen is greatly increased in the presence of a mineral acid. The reaction-velocity in acid solution is nearly constant, and the velocity-coefficient is practically identical with the coefficient calculated for the substitution reaction from the data obtained in the experiments with bromine.

The experimental facts suggest that halogen substitution in the aldehydes is conditioned by preliminary isomeric transformation of the aldehyde from the ketonic to the enolic form, the velocity of this change being greatly increased in the presence of acids.

112. "Equilibrium in the system: ethyl alcohol, acetic acid, ethyl acetate, and water, and its apparent displacement by mineral chlorides." By James Fletcher and William Jacob Jones.

It has already been shown (T., 1911, 99, 1427) that hydrogen chloride disturbs the above equilibrium owing to the formation of hydrate. In the present investigation these observations have been extended so as to include lithium and calcium chlorides.

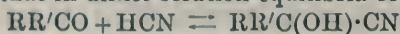
113. "The mechanism of cyanidion catalyses."

By William Jacob Jones.

A chemico-dynamical investigation of the interaction between hydrogen cyanide and certain organic anions containing a double bond was described. It was shown that the speed of addition was proportional to the concentration of cyanidion present.

114. "The interaction between hydrogen cyanide and aldehydes and ketones in dilute solution." By William Jacob Jones.

It was shown that in dilute solution equilibria of the type:



are established. Water and, to a less extent, alcohol exert a dissociative influence on cyanohydrins.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Istrati, *C. I.* Studiu relativ la o nomenclatură generală în chimia organică. București 1913. pp. vii + 1223. (*Recd.* 5/3/14.)

From Professor A. W. Crossley.

Le Chatelier, *Henry Louis*. La silice et les silicates. Paris 1914. pp. 574. (*Recd.* 2/3/14.)

From the Author.

Tollens, *Bernhard*. Kurzes Handbuch der Kohlenhydrate. 3rd edition. Leipzig 1914. pp. xx + 816. ill. M. 22.—. (*Recd.* 16/3/14.)

From the Publisher: Johann Ambrosius Barth.

II. *By Purchase.*

Abderhalden, *Emil*. Lehrbuch der physiologischen Chemie. 3rd edition. Part I. Berlin 1914. pp. viii + 736. M. 21. (*Recd.* 11/2/14.)

Bauer, *Hugo*. Der heutige Stand der Synthese von Pflanzenalkaloiden. Braunschweig 1913. pp. viii + 144. M. 4.50. (*Recd.* 13/3/13.)

Böhm, *C. Richard*. Die Verwendung der seltenen Erden. Leipzig 1913. pp. viii + 107. ill. M. 4.50. (*Recd.* 11/2/14.)

Dekker, *J.* Die Gerbstoffe. Botanische-chemische Monographie der Tannide. Berlin 1913. pp. xiii + 636. M. 20.—. (*Recd.* 13/2/14.)

Don, *John*, and Chisholm, *John*. Modern methods of water purification. 2nd edition. London 1913. 15s. net. (*Recd.* 11/2/14.)

Kohler, *Hippolyt*, and Graefe, *Edmund*. Die Chemie und Technologie der natürlichen und künstlichen Asphalte. 2nd edition. Braunschweig 1913. pp. xxi + 504. ill. M. 18.—. (*Recd.* 11/2/14.)

Schmidlin, *Julius*. Das Triphenylmethyl. Stuttgart 1914. pp. xii + 233. M. 8.—. (*Recd.* 13/3/14.)

INFORMAL MEETING.

The Rooms of the Society will be open for an informal meeting of the Fellows on Thursday, April 30th, from 8 to 10 p.m. Smoking will be permitted, and light refreshments will be provided. Fellows are invited to exhibit apparatus and specimens of interest, and to show experiments; those wishing to do so are requested to communicate with the Honorary Secretaries not later than the Monday previous to the meeting.

THE FARADAY LECTURE.

The Faraday Lecture, entitled "Electrolytic Dissociation," will be delivered by Professor Dr. Svante Arrhenius, F.R.S., on Monday, May 25th, at 6 p.m. The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Each Fellow of the Society is entitled to two tickets, which may be obtained on application to the Assistant Secretary, Chemical Society, Burlington House, W.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on or before Monday, June 1st, 1914.

All persons who received grants in June, 1913, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Honorary Secretaries by June 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Scientific Meeting on Thursday, **May 7th**, 1914, at **8.30 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Researches on santalin. Part II." By J. C. Cain, J. L. Simonsen, and C. Smith.

"The nature of molecular association. Its relation to chemical combination." By W. E. S. Turner and S. English.

"The action of diastase on starch granules." By J. L. Baker and H. F. E. Hulton.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, May 7th, 1914.

Ahmad, Abdel Hameed (B.Sc.) Birm.,
The University, Birmingham.

Post-graduate, doing research work in Organic Chemistry at the Birmingham University.

Percy F. Frankland.

C. Kenneth Tinkler.

Hamilton McCombie.

Edward P. Frankland.

Frederick Challenger.

Armstrong, Charles Frank,

Marhourab, B. and N.-W. Ry., Saran, Behar.

Chemist and Manager, Marhourah Sugar Works. 1904–6, Student in the Chemical Dept., South Western Polytechnic, Chelsea; 1906 and 1907, Assistant to Dr. Thorne (Southampton Wharf, Battersea); 1908 onwards, Chemist, Marhourah Sugar Plantation and Factory.

Leonard Temple Thorne.

J. C. Crocker.

J. Bernard Coleman.

Ernest Feilmann.

E. Haynes Jeffers.

Bacon, Raymond Foss,

Pittsburgh, Pa.

Associate Director, Melton Institute of Industrial Research. University of Pittsburgh. B.Sc. Depaun Univ. 1899, M.A. (same), 1900, Ph.D. Univ. of Chicago, 1904; Professor in Univ. of Pittsburgh 1911, —Author of contributions to Scientific Journals on Philippine Terpenes, Essential Oils, Medicinal Plants, Food Products, Tropical Sunlight, etc.

Alexander Smith.

Robert Kennedy Duncan.

S. F. Acree.

J. Livingston R. Morgan.

Marston Taylor Bogert.

Baxter, Arthur,

360, York Road, Camden Road, N.

Teacher. Bachelor of Science (London). Science Teacher at the

"Acland" Central L.C.C. School. Board of Education's School-master's Certificate. Nine Advanced Science Certificates (Board of Education).

George Senter.

Geoffrey Martin.

Fred Barrow.

G. W. Clough.

Edward Lewis James.

Baxter, Frederick Stanley,

119, Albert Street, Regent's Park, N.W.

Analytical Chemist. Four years as Assistant to Mr. F. J. Lloyd, F.I.C. Six years Chemist and Analyst to the British Malt Products Co., 1, Market Street, S.E. and Dunbar, Scotland.

Fredk. J. Lloyd.

L. O. Newton.

Alex. MacFarlane.

R. T. Thomson.

Harold Baron.

Baxter, Robert Reginald,

St. John's College, Oxford.

Research Assistant to Prof. W. H. Perkin, formerly Scholar of St. John's College, Oxford. B.A. Hon. School Chemistry, Oxford. Assistant Demonstrator at the Christ Church, Lab. Published paper in *J.C.S.* (vol. 103, p. 1986) with Dr. F. D. Chattaway on "The Action of Nitrogen Iodide upon Methyl Ketones."

W. W. Perkin.

B. Lambert.

F. D. Chattaway.

A. F. Walden.

N. V. Sidgwick.

W. B. Shaw.

Bayley, Charles Wesley,

63, Caxton Road, Wood Green, N.

Pharmacist and Analyst. Present Appointment, Superintendent "Apothecaries' Hall," Soc. of Apothecaries, London, E.C. Registered Chemist and Druggist, Qualified Dispenser Soc. of Apothecaries London. Science and Art Certificates, South Kensington: Practical Organic 1st class, Theo. Inorganic Chemistry Adv. 2nd class; Practical Inorganic Adv. 1st class, Theo. Inorganic Chemistry Elem. 1st class; Practical Inorganic Elem. 1st class. Student of the late W. Watson Wills, F.C.S., Ph.C. I am desirous of becoming a Fellow of the Chemical Society in order that I may keep in touch with modern Chemical Research.

Maurice Brooks Jack.

H. Lucas.

Isaac S. Scarf.

E. J. Jackman.

F. Filmer De Morgan.

Bishop, Robert Odell,

1, Augustine Road, West Kensington.

Analytical Chemist to Messrs. Fullers Ltd., Confectioners. Obtained Certificates of the City and Guilds Inst. after 3 years at the Technical College, Finsbury. One year's Senior Studentship in the Research Lab. of Professor Meldola. Passed the Intermediate Exam. for the Associateship of the Institute of Chemistry.

R. Meldola.

W. F. Hollely.

B. H. Buttle.

H. Droop Richmond.

A. J. Hale.

E. R. Bolton.

Coulthard, Albert,

9, Portland Avenue, Stamford Hill, London, N.

Lecturer in Chemistry. B.Sc. (Hons. School Chemistry), Manchester, 1898; Ph.D. (*magna cum laude*), Freiburg i. B., 1910. Dissertation on "*Merkaptane der Anthrachinonreihe*." Papers on (1) "*The Dinitrobenzidines: A New Form of Isomerism*" (in conjunction with Cain and Micklethwait); (2) "*Derivatives and Substitution Products of the two Isomeric o-Dinitrobenzidines*" (in conjunction with Cain and Micklethwait); (3) "*New Dyestuffs Derived from Methylethylaniline*" (in conjunction with Cain).

Harold B. Dixon.

Gilbert J. Fowler.

Arthur Lapworth.

J. E. Myers.

Norman Smith.

E. Hope.

Craig, Robert Barclay,

50, North Albion Street, Glasgow.

Chemist. Four years Assistant Chemist with the North British Railway Company and one year with Nobel's Explosives Coy., Ardeer. At present, Chemist with The Nickel Company, Kirkintilloch. Studied Chemistry at The Royal Technical College, Glasgow. I am desirous of joining the Society in order that I may follow closely the progress of Chemical Science.

A. D. Gardiner.

Norman Picton.

William Dallas.

F. J. Wilson.

Archibald Knox.

D. H. Peacock.

Foulds, Robinson Percy (M.Sc.),

Stanley Villa, Colne, Lancs.

Member of Firm of Th. Foulds & Son, Manufacturing Chemists, Green Shed, Colne. B.Sc. (Hons. in Chemistry) 1911.; M.Sc. (by Research) 1912; worked with Prof. R. Robinson on Saffrole and Iso-

Safrole; Author of "2-Phenyl-5-styryloxazole" in *Proc. Chem. Soc.*, 1913.

Harold B. Dixon.

J. E. Myers.

Arthur Lapworth.

F. R. Lankshear.

Ch. Weizmann.

F. P. Burt.

Galt, Hugh Miller,

Elm Croft, Withdean, Brighton.

Pathologist and Bacteriologist, "Stephen Ralli" Memorial Laboratory, Royal Sussex County Hospital, Brighton. B.Sc., M.B., F.R.F.P.S. (Glas.); D.P.H. (Cams.); Late Professor of Legal Medicine and Public Health, St. Mungo's College, Glasgow; Late Assistant Professor of Legal Medicine and Public Health, Glasgow University; Double Medallist and "Mackay Smith" Scholar in Chemistry, Glasgow University, etc. etc.

M. C. Clutterbuck.

William H. Gibson.

William Jago.

Alfred E. Sibson.

Alfred W. Oke.

Ghosh, Brojendranath,

59, Hereford Road, Bayswater, W.

M.Sc. (Calcutta). Conducting Research Work at University College, London.

Samuel Smiles.

H. T. Clarke.

R. Wright.

C. R. Crymble.

J. N. Collie.

Haskew, Richard Selwyn,

"Cwmbran," Newport, Mon.

Manager's Assistant, The Cwmbran Chemical Co., Ltd. Completed Diploma Course at the City and Guilds College, S. Kensington, in the Dept. of Chemistry, obtaining Diploma of A.C.G.I.; Continuing Work at the College carried out under Prof. Armstrong—Research Work on certain Glucosides and Hydrolysis; Hon. Secretary, City and Guilds College Chemical Society, 1910–12; In 1912, obtained Appointment as Manager's Assistant, The Cwmbran Chemical Co., Ltd.

Henry E. Armstrong.

W. Robertson.

G. T. Morgan.

J. Vargus Eyre.

Edward Wheeler.

Heyrovský, Jaroslav,

24, Agincourt Road, N.W.

Student at University College, London. B.Sc. (Honours in Chemistry); Demonstrator in Physical Chemistry (University College).

F. G. Donnan.

Samuel Smiles.

J. N. Collie.

R. E. Slade.

R. Whytlaw Gray.

S. G. Sastry.

Hobson, Arthur Bertram (M.Sc.),

13, Westy Lane, Latchford, Warrington.

Works Chemist. B.Sc. 1st Class Honours in Chem., University of Manchester; M.Sc. by Research; Chemist in Richmond Gas Stove Co., Warrington.

Harold B. Dixon.

W. J. Jones.

F. P. Burt.

Arthur Lapworth.

Ch. Weizmann.

E. Hope.

J. E. Myers.

Hodges, Trevor Edward,

43, Stapleton Hall Road, Stroud Green, N.

Third Year Chemical Student at Finsbury Technical College with the intention of becoming a professional Chemist; being desirous of receiving the Society's publications and of attending the meetings.

R. Meldola.

B. H. Buttle.

A. J. Hale.

W. F. Hollely.

G. E. Shaw.

J. Huck.

Hudleston, Lawson John,

68, Parliament Hill, Hampstead, London, N.W.

Chemical Research Student. I have studied Chemistry for four years in University College, London University, and have graduated there with honours in Chemistry.

Samuel Smiles.

R. Whytlaw Gray.

R. E. Slade.

W. B. Tuck.

V. Lefebure.

MacIvor, Ralph Waldo Emerson,

47, Victoria Street, Westminster.

Analytical and Consulting Chemist; Fellow of the Society for 14 years: F.I.C.; Author of many contributions to Chemical Journals. Formerly Consulting Chemist to Governments of Victoria and South Australia, &c., &c.,

William Ramsay.

George McGowan.

Otto Hehner.

Arthur R. Ling.

William Crookes.

Myddleton, William Whalley,

6, Fairfield Road, Latchford Without, Warrington.

Research Chemist; B.Sc. Degree, Belfast University, 1911; M.Sc. Degree, Belfast University, 1912.

T. P. Hilditch.

A. W. Stewart.

E. A. Letts.

A. K. Macbeth.

John Hawthorne.

Newton, Arthur Ulysses,

37, Netherhall Gardens, Hampstead, N.W.

Research Student (Chemistry) at University College, London. Student of Science at University College since 1910. Demonstrator in Chemistry (1912-13). B.Sc. (London), First Class Honours in Chemistry.

J. N. Collie.

Samuel Smiles.

F. G. Donnan.

R. Whytlaw Gray.

Irvine Masson.

Partington, James Riddick,

The University, Manchester.

Assistant-lecturer in Chemistry in the University of Manchester. B.Sc. University Scholarship, 1909; Beyer Fellow, 1910; researched with Prof. Nernst, 1911-13, author of following papers (among others):—"Cholesterol and Fatty Acids," Trans., 1911; "Determination of Dissociation pressures of Hydrated Salts by a Dynamical Method," Trans., 1911. "Temp. Coeff. of the Electrical Conductivity of Hydrogen Chloride in Alcoholic Solution," Trans., 1911. "Electromotive Forces in Alcohol" (with Prof. Lapworth), Trans., 1910 and 1911. "Bestimmung des Verhältnisses der Specifischen Wärmen der Luft und Kohlensäure. Phys., Zeitsch., 1913.

Harold B. Dixon.

W. J. Jones.

Ch. Weizmann.

A. Lapworth.

F. P. Burt.

E. Hope.

Norman Smith.

Pratt, Walter Ryley,

17, Bloomsbury Sq., W.C.

Assistant-lecturer in Chemistry and Physics, Pharmaceutical Society's School of Pharmacy. B.Sc. (Lond.) Honours Chemistry; A.I.C.; Pharmaceutical Chemist, Jacob Bell Scholar; Neil Arnott Scholar; Salter's Fellow; Demonstrator at Pharmaceutical Society's School. Author and joint author of six research papers contributed to the Chemical Society, Pharmaceutical Society and British Pharmaceutical Conference.

Arthur W. Crossley.

Charles A. Keane.

J. T. Howitt.

Charles H. Warner.

G. Francis Morrell.

Ratcliffe, Henry,

38, Sefton Terrace, Beeston Hill, Leeds.

Technical Chemist. Chief Chemist to The Leeds Phosphate Works, Ltd., Leeds. (South Kensington) Honours Chemistry (Practical)

Honours Metallurgy (Theory and Practical). City and Guilds. (Iron and Steel manufacture).

B. A. Burrell.

N. D. Ridsdale.

Thomas Fairley.

H. Frankland.

C. H. Ridsdale.

Ernest W. Jackson.

Reeve, Walter William,

4, Gowlett Road, East Dulwich, S.E.

Bachelor of Science (London), University College.

J. N. Collie.

Samuel Smiles.

F. G. Donnan.

H. T. Clarke.

V. Lefebure.

Reynard, Herbert Corner,

West Ewell, Surrey.

Student. B.Sc. (Lond.) 1st Class Hons. Chemistry.

J. Norman Collie.

Samuel Smiles.

F. G. Donnan.

R. Whytlaw Gray.

James W. Horseman.

Rogers, John,

195, W. George St., Glasgow.

Technical Advisor to Nobel's Explosives Co. Ltd. Student, Glasgow and West of Scotland Technical College, 1894-1897. Assistant to Dr. Henderson at above College, 1897-1898. Research Chemist, Nobel's Ardeer Factory, 1898-1908. Present appointment from 1908. Fellow of the Institute of Chemistry.

Wm. Rintoul.

N. Picton.

D. H. Peacock.

Wm. Barbour.

G. H. Beckett.

W. R. Moore.

Rundell, Percy Charles,

Glenthorne, St. Albans Crescent, Woodford Green, Essex.

Analytical Chemist. Have studied Chemistry since the age of 16 (6 years). For 3 years (Nov. 17th, 1909, to Nov. 17th, 1912) was an articulated pupil to Mr. Leo Taylor, F.I.C., Public Analyst. For nearly two years I have been an Assistant Chemist at Messrs. Johnsons & Son's Smelting Works, Finsbury, E.C.

F. B. Thole.

Charles A. Keane.

A. E. Dunstan.

B. C. Smith.

R. P. Hodges.

Seal, Lall Behary,

Rangoon, Burma.

3rd Assistant Chemical Examiner to Govt. Burma. 1905 to 1907—General Assistant to the Chemical Examiner's Laboratory, Medical College, Calcutta. 1908 to Oct., 1911—Assistant to the Chemical

Examiner to Government of Bengal and Professor of Chemistry, Calcutta Medical College. Oct., 1911, to present date—3rd Assistant Chemical Examiner to Government, Burma.

J. N. Rakshit.

Haradhan Ray.

K. B. Seal.

R. L. Jenks.

M. N. Banerjee.

Tagg, Max Herbert, B.Sc.

"Brentor," Clayton Ave., Wembley, Middlesex.

Head Master of the Acton and Chiswick Trade School. As Student : 1898–1902 Dartford Technical Institute; 1904–6, King's College, London, Science Faculty; 1907–8, Manchester School of Technology, Bacteriological Dept.; 1909–10, Liverpool University, Chemical Dept. As Lecturer in Chemistry: 1907–9, Technical Institute and Secondary School, Hyde, Manchester. 1909–10, Toxteth Technical Institute, Liverpool.

James C. Philip.

John M. Thomson.

Henry Bassett, jun.

Herbert Jackson.

A. W. Titherley.

Patrick H. Kirkaldy.

White, Norman Cecil,

35, Spencer Park, Wandsworth, S.W.

Student. Exhibitioner in Natural Sciences,—Trin. Coll. Camb., 1912. B.A. (Camb.) Part I, Nat. Sciences Tripos, 1912; Part II, Nat. Sciences Tripos, 1913. B.Sc. Hons. (Lond.), 1913.

Arthur W. Crossley.

J. N. Collie.

F. G. Donnan.

R. Whytlaw Gray.

William J. Pope.

Wintle, Albert Watkins Maggs,

Holly House, Saltcoats, Ayrshire.

Assistant in the Research Laboratories of Nobel's Explosives Company, Ltd., Ardeer Factory, Ayrshire; was 2½ years lecture assistant to the late W. A. Shenstone, F.R.S. at Clifton College. Matriculated 1909. Studied Chemistry at Merchant Venturers' Technical College and University of Bristol, and at Royal Technical College, Glasgow. Passed Inter. B.Sc. in Physics and Chemistry. One year in the Analytical and 2½ years in the Research Laboratories of Nobel's Explosives Co., Ltd.

G. G. Henderson.

N. Picton.

Thomas Gray.

D. H. Poacock.

William Rintoul.

G. H. Beckett.

William Barbour.

The following Certificates have been authorised by the Council for presentation to ballot under Bye-law I. (3) :

Bryant, Edward Godfrey,

Grey Institute, Port Elizabeth, S. Africa.

Science Master at above School (1901-1913); formerly Science Master at Pontefract (Yorks) Secondary and Technical Schools (1896-1901). B.A., B.Sc. (London University). Small Analytical Practice for P.E. Municipality; Divisional Council, etc. Contributions to *Chemical News* on "Magnesium and Water" (March 25, 1898; Feb. 17, 1899; Nov. 3, 1899); "Chemical Action of Polarised Light" (1913), and other short articles.

J. E. Devlin.

W. Lowson.

J. B. Cohen.

William Crookes.

W. H. Perkins.

R. M. Caven.

Gill, Clifford Girdlestone,

Uncertain; at present Cawnpore, India.

Distillery and Sugar Technologist, at present Manager of Cawnpore. Sugar Works Ltd. Distillery. Educated at private schools in England and at King's College, London, and Margate Grammar School; 5½ years. Been in charge of Distillery and CO₂ Plant in Messrs. Parry & Co's Factory at Nellilsuppam, and of Sugar House and Laboratory in same Company's Factory at Kulasekharapatnam; previously at Amritsar Distillery, now in charge of Cawnpore Sugar Works Ltd. Distillery at Cawnpore. Object, to keep in touch with progress of Chemistry.

F. Camp.

C. S. Fawcitt.

Harrison, Alfred Cornwell,

Penhalonga, Rhodesia, S. Africa.

Assayer and Chemist, Rerende Mines, Ltd., Penhalonga. 1907-1909, Assistant Analyst to Dr. R. Marloth, Chemical and Bacteriological Laboratory, Cape Town; 1910-1911, Assistant Assayer, Rerende Mines, Ltd.; 1911—, Chief Assayer and Chemist, Rerende Mines, Ltd.

Andrew Young.

J. McCrae.

F. W. Watson.

Maitra, Birendranath,

10, Kalighat Road, Bhowanipur, Calcutta, India.

Assistant, C.E. College. M.Sc. of the Calcutta University in Chemistry. Assistant to the Professor of Chemistry in the Govt. Engineering College at Sibpore (Bengal).

R. N. Sen.

Haradhan Ray.

Paul Brühl.

B. B. Dutta.

Mulla, Yusuf Ismail,

Alembic Laboratory, Club Road, Mandalay Shore, Burma,
India.

F.S.Sc., M.S.A., M.R.A.S., President of International Mohammedan Association, Member of the Council of the Society for Supervision and Conservation of Religious Endowments of Burma. Delegate to the Indian National Congress to represent Rangoon. General Merchant and Pharmaceutical Chemist. Has been practicing as Chemist some years and gained good experience. Studied Chemistry and Pharmacy for three years and is still studying Chemistry, and interested in research work. One of the reasons of desiring admission is to increase the knowledge of Chemistry by reading and studying the lectures, discourses, discussions and other matters on the Science contained in the Society's Journal and other publications, and to make communications, etc. Graduate of Ohio Institute of Pharmacy, Ohio, U.S.A. Graduated in 1904 for graduate and post-graduate courses. Diploma.

Thein Kin.

J. C. Mascarenhas.

G. M. Lloyd.

Henry E. Stevenson.

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30

No. 429.

Thursday, May 7th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

Certificates were read for the first time in favour of Messrs.:

Alfred Archibald Boon, D.Sc., Heriot-Watt College, Edinburgh.

John Vernell Cutler, Rose Cottage, Farringdon Lane, Ribbleson, Preston.

Galstaun Shanazar Galstaun, B.A., Abbotsholme, Derbyshire.

James Mylam Gittins, M.Sc., South Lynn, Limes Road, Folkestone.

Alfred Holt, 32, Britain Street, Bury.

John Cyril Jennings, Rosindell, Fairlop Road, Leytonstone, N.E.

Hashmat Rai, B.A., M.Sc., Chemical Buildings, Government College, Lahore, India.

Frederic Robinson, M.Sc.Tech., The Hollies, Mile End, Stockport.

Walter Edward Rowbottam, 23, Darville Road, Stoke Newington, N.

Alfred John White, B.Sc., Hawes Down, West Wickham, Kent.

Messrs. W. Sloan Mills and P. C. Austin were elected Scrutators, and a ballot for the election of Fellows was held. The following were subsequently declared as duly elected:

Abdel Hameed Ahmad, B.Sc.

Charles Frank Armstrong.

Raymond Foss Bacon, B.Sc., M.A.,
Ph.D.

Arthur Baxter, B.Sc.

Frederick Stanley Baxter.

Robert Reginald Baxter, B.A.

Charles Wesley Bayley.

Robert Odell Bishop.

Edward Godfrey Bryant, B.A., B.Sc.

Albert Coulthard, B.Sc., Ph.D.

Robert Barclay Craig.

Robinson Percy Foulds, M.Sc.

Hugh Miller Galt, B.Sc., M.B., D.P.H.

Brojendranath Ghosh, M.Sc.

Clifford Girdlestone Gill.

Alfred Cornwall Harrison.

Richard Selwyn Haskew.

Jaroslav Heyrovský, B.Sc.

Arthur Bertram Hobson, M.Sc.

Trevor Edward Hodges.

Lawson John Hudleston.

Ralph Waldo Emerson MacIvor.

Birendranath Maitra, M.Sc.

Yusuf Ismail Mulla.

William Whalley Myddleton, M.Sc.

Arthur Ulysses Newton, B.Sc.

James Riddick Partington, B.Sc.

Walter Ryley Pratt, B.Sc.

Henry Ratcliffe.

Walter William Reeve, B.Sc.

Herbert Corner Reynard, B.Sc.

John Rogers.

Percy Charles Rundell.

Lall Behary Seal.

Max Herbert Tagg, B.Sc.

Norman Cecil White, B.A., B.Sc.

Albert Watkins Maggs Wintle.

Of the following papers, those marked * were read :

***115. "Researches on santalin. Part II."**

By John Cannell Cain, John Lionel Simonsen, and Clarence Smith.

As a result of determinations of the molecular weight of certain derivatives of santalin by Barger's method, the authors are of the opinion that the formula previously assigned to this colouring matter should be doubled, and hence should be $C_{30}H_{28}O_{10}$.

The presence of four benzene rings in the santalin molecule appears also to be indicated by the facts that (1) the monomethyl ether yields, on oxidation, a mixture of anisic and veratric acids, and (2) nitrosantalin dimethyl ether yields four different benzenoid acids on oxidation.

Santalin yields anthracene on distillation with zinc dust (Grandmougin), and the authors suggest that it is probably a dianthracene derivative.

DISCUSSION.

Dr. TURNER suggested that the low molecular-weight values found for santalin in phenol might be due to combination with the solvent. Of the other solvents employed, ether was most likely to lead to the simplest (or normal) molecular weight.

***116. "The nature of molecular association. Its relation to chemical combination." By William Ernest Stephen Turner and Solomon English.**

The term "association" is frequently used to denote both the phenomenon of the formation of complexes of similar molecules and of dissimilar molecules (formation of molecular compounds).

Further, views have been expressed to the effect that the formation of molecular compounds is a natural consequence of molecular association in the component substances.

In order to test how far these views are truly founded, the subject was investigated by a review of the different classes of substances which form molecular compounds and by an investigation of the behaviour in benzene, bromoform, chloroform, and water of mixtures of (1) alkyl and aryl haloids, (2) associated organic substances, (3) associated organic substances and alkyl or aryl haloids, (4) salts, (5) salts and alkyl or aryl haloids, (6) salts and associated organic substances, (7) alkyl or aryl haloids and iodine, (8) salts and iodine, (9) associated organic substances and iodine. A study was also made of the mixture of α -naphthylamine and phenol, in which combination is known to occur.

It was shown that whilst associated substances have a marked tendency to form molecular compounds, mixtures of associated substances can often be obtained without chemical combination, and, on the other hand, molecular compounds are also produced by non-associated substances.

Mixtures of salts in bromoform, so far from dissociating each other, actually produce increased association. In one or two cases investigated the increased association passes through a maximum at a certain concentration, and then diminishes to zero. Similar behaviour is found in chloroform, and also in water, but in the latter to a less extent.

Benzoic and acetic acids have but little effect on one another, but in some other cases of organic associated substances, each constituent influences the other, probably by combination.

Alkyl or aryl haloids and iodine, and organic associated substances and iodine have but little effect on one another; a nitrate in bromoform solution acts with iodine to some extent, but not nearly so much as chlorides, bromides, and iodides, which form periodides, these in turn apparently becoming associated.

***117. "The action of diastase on starch granules. Part I."**

By Julian Levett Baker and Henry Francis Everard Hulton.

Brown and Morris (T., 1890, 57, 510) have stated that when precipitated malt diastase is allowed to act at the ordinary temperature on the granules of barley starch, the whole of the optically active substance produced is maltose. Later Morris (T., 1901, 79, 1085) confirmed the observation in the case of malt extract, but when precipitated diastase was used a smaller yield was obtained, and the product was stated to consist of a mixture

of maltose and dextrin. No experimental evidence was adduced in support of this assertion.

The authors bring forward experimental evidence to show that the similarity to maltose of the specific rotatory power and the cupric reducing power of the products so formed at temperature varying between 15.5 and 37.5 is fortuitous.

On submitting the products of such action to fermentation, alcoholic fractionation, and dialysis, a dextrin was isolated which had a molecular weight exceeding 1500, an $[\alpha]_D$ of 177°, and a cupric reducing power varying between 11 and 20 per cent. of maltose. This dextrin, which is not identical with the "stable dextrin" of Brown and Millar (T., 1899, 75, 315), constitutes about 1/5th of the conversion products, from which crystalline maltose was also isolated, and a dextrin or dextrins of the same molecular weight and optical activity as maltose, but of much lower cupric reducing power. When the time of conversion exceeds three or four days dextrose is produced.

DISCUSSION.

Dr. PLIMMER pointed out that French observers consider that starch granules consist of two constituents.

The formation of small quantities of dextrose by the action of malt diastase might arise from one of these two constituents, and not from the other, which yields only maltose on hydrolysis.

In reply, Mr. BAKER said that he did not think that Maquenne and Roux's differentiation of the starch granule into amylocellulose and amylopectin affected the question of the formation of dextrose. If the dextrose were derived directly from one or other of these substances, it would be reasonable to expect its production at once, but the experimental evidence was against this. It was more probable that the dextrose was formed by the slow hydrolysis of some of the dextrins of low molecular weight present in the conversion products.

*118. "The atomic weight of lead from Ceylon thorite."

By Frederick Soddy and Henry Hyman.

Recent results in radioactivity suggest that the lead derived from a mineral rich in thorium and poor in uranium may have an appreciably higher atomic weight than that of ordinary lead. If the end products of both uranium and thorium are, as is supposed, the isotopes of lead, the former should have an atomic weight of 206 and the latter of 208.4, whilst the accepted value for ordinary lead is 207.1. Ceylon thorite is uniquely suited for an experimental test of the question. The original analysis (W. R. Dunstan,

Ceylon Mineralogical Survey Report, March 31st, 1904) gave 58.24 per cent. of thorium, 0.38 per cent. of uranium, and no lead. The authors' analysis gave 0.35 per cent. of lead and 54.5 per cent. of thorium. Whereas the chemical estimation of the uranium gave 0.72 per cent., a later preliminary estimation of the radium by the emanation method showed more uranium, namely, 1.6 per cent., and this is probably the more accurate. Owing to its greater rate of change, uranium will be about three times as effective in producing lead as thorium, so that if the lead in Ceylon thorite is entirely of radioactive origin, and if both isotopes are stable, the atomic weight should be 208.2.

Rather more than a gram of the finally purified lead chloride was obtained from about a kilogram of the mineral, and used in the determinations. Exactly similar estimations with it and with ordinary lead chloride, purified by an identical series of processes, have shown that the thorite lead has distinctly the higher atomic weight. The determinations are purely relative, the atomic weight of ordinary lead being taken as 207.1. The method adopted followed, in part, that of Baxter and Wilson. The lead chloride was fused in hydrogen chloride before weighing, and its solution titrated with silver nitrate solution, the end point being determined without an indicator by the cloud method. Two separate determinations showed a difference of between 0.4 and 0.5 per cent. in the volumes of the silver nitrate solution required by equal weights of the two chlorides, whereas the errors of the estimation do not probably exceed 0.1 per cent. The relative atomic weight of the thorite lead calculated from the results is 208.4. The determinations so far carried out do not suffice to settle the question, but they show clearly a difference in the expected direction of the right order of magnitude.

From a preliminary examination with the Féry spectrograph, the spark spectra of the two specimens of lead, between 6656.3 and 2170, appear to be identical, except for the line 4760.1, which is much weaker in the thorite lead than in ordinary lead.

***119. "A criticism of the hypothesis that neutral salts increase the dissociation of weak acids and bases" By James William McBain and Frederick Charles Coleman.**

It was shown that if the hypothesis of Acree, Bredig, Snethlage, etc., is accepted, namely, that undissociated hydrochloric acid catalyses the inversion of sucrose better than hydrogen ion, and if, further, the data of A. A. Noyes and his collaborators are employed, not only do the data of Arrhenius (1899) for the acceleration caused by adding a neutral salt to a weak acid fail to prove

that the dissociation-constant of the weak acid is enhanced by the presence of the neutral salt, but they may even be adduced as strong evidence against the existence of such an effect.

It was further pointed out that much of the evidence brought in support of the enhancement hypothesis is derived from methods often subject to grave systematic errors, involving, for instance, colour changes in colloidal or electrolytic colloidal systems, or distribution data—methods which are known in some cases to give highly distorted results. Here the results are conflicting in order of magnitude, and even in sign. The evidence of electromotive-force measurements is also unfavourable to the hypothesis.

The authors conclude, therefore, that on the whole there is no experimental evidence for the supposed increase in the dissociation-constant of weak acids and bases caused by the presence of neutral salts.

120. "Studies in substituted quaternary azonium compounds containing an asymmetric nitrogen atom. Part II. Resolution of phenylbenzylmethyazonium iodide into optically active components" By Bawa Kartar Singh.

The author, in continuation of his work (T., 1913, **103**, 604), has prepared externally compensated phenylbenzylmethyazonium iodide by two different methods, namely, (i) by the action of methyl iodide on phenylbenzylhydrazine, and (ii) by the action of benzyl iodide on phenylmethylhydrazine. In the second reaction there is also produced, owing to substitution having taken place, benzyldimethyazonium iodide, $(C_7H_7)(CH_3)_2(NH_2)NI$.

The resolution was effected with the aid of *d*-camphor- β -sulphonic and *d*- α -bromocamphor- β -sulphonic acids. In each case the first fractions consisted of pure *d*BdA component; in the last fractions the two component salts *d*BdA and *l*BdA formed solid solutions. The *l*BdA component could not therefore be obtained in a pure state, and the process of resolution was very slow and partial.

No mutarotation was observed in the case of any of the compounds obtained.

Several salts of the externally compensated and optically active azonium base were described.

121. "Contributions to the chemistry of the terpenes. Part XVII. The action of hypochlorous acid on camphene." By George Gerald Henderson, Isidor Morris Heilbron, and Matthew Howie.

When treated with dilute aqueous hypochlorous acid camphene gives a quantitative yield of a *chlorohydrin*, $C_{10}H_{16}Cl \cdot OH$, a crystalline solid, m. p. 93° . This compound reacts readily with

aqueous or alcoholic alkalis, yielding *isocamphenilanaldehyde*, and by the action of phosphorus pentachloride is converted into camphene dichloride, $C_{10}H_{16}Cl_2$. *isoBorneol* is obtained by the action of zinc and alcohol on the chlorohydrin, which therefore is a *chloroisoborneol*. On oxidation with chromium trioxide the chlorohydrin is converted into a crystalline *chloroketone*, $C_9H_{15}Cl.CO$, m. p. 132° , which gives camphor when heated with zinc and alcohol.

122. "Reactions by trituration" By Leslie Henry Parker.

It has been shown by Carey Lea (*Phil. Mag.*, 1892, [v], **34**, 46; 1893, **36**, 351; 1894, **37**, 31, 470) that shearing stress is capable of "disrupting the molecule" of many endothermic compounds, being far more efficient in this respect than simple pressure of enormous magnitude. This fact, combined with the results of Spring's work on the sulphates and carbonates of sodium and barium (*Bull. Soc. chim.*, 1885, [iii], **44**, 166; 1886, **46**, 299), was the cause of the present investigation into the interaction of various salt pairs, presumably in the solid state, by trituration.

Various pairs of salts were thoroughly dried, and ground together in a dry atmosphere. In most cases mutual action took place very easily, but not always. It was noticed that those substances which reacted most easily under the pestle were those which were easily fusible in ordinary circumstances, and vice versa, and the author arrives at the same conclusion as Johnston and Adams (*Amer. J. Sci.*, 1913, [iv], **35**, 205), that shearing stress, or "non-uniform" pressure, causes local or surface fusion of the substance to which it is applied.

It can also be shown that the action of shearing stress is fundamentally different from that of simple pressure, the chief difference lying in the fact that the products of any reaction occasioned by shearing stress are not necessarily denser than the reacting substances. Experiments have also been conducted with the object of determining whether the trituration caused any ionisation of the atmosphere round the ground substances, but without success.

123. "The reaction between dilute acid solvents and soil phosphates." By James Arthur Prescott.

The author has investigated the action of dilute acid solvents on soil with respect to the amount of phosphoric oxide extracted. The extractions were made at constant temperature for varying lengths of time, and with initial concentrations of from 0.06 to 0.2 equivalents of acid per litre.

The amount of phosphoric oxide extracted is approximately proportional to the initial strength of the extracting acid. With nitric, hydrochloric, and sulphuric acids, an increase in the time of extraction brings about a decrease in the amount of phosphoric oxide extracted. With citric acid the reverse is the case.

The amount of acid neutralised by the soil increases with the time of extraction, but an excess of acid always remains, large in proportion to the amount of phosphoric oxide present. The greatest diminution in the quantity of phosphate extracted with increase in time of extraction occurs with soils containing the highest proportion of clay. It is difficult to account for the removal of the phosphoric oxide from the solution on chemical grounds in view of the large excess of acid present, and the phenomena were therefore studied from the point of view of adsorption.

The results obtained by Hall and Amos (T., 1905, 89, 205) were found to agree with the adsorption relationship established by Freundlich:

$$Y/M = KC^{1/p},$$

where Y = amount adsorbed by a quantity M of adsorbent, and C = equilibrium concentration of the solution.

For the Saxmundham soil $p=0.58$; for the Broadbalk soils (5 and 8) $p=1.63$; for the Hoos soil (2A.1) $p=1.414$.

In these results, a correction has to be made for the amount of phosphate still left in the soil.

The author has further investigated this point by adding known amounts of phosphate to a soil, and the curves obtained led to the conclusion that the amount of phosphate originally present in the soil, and soluble in hydrochloric acid, was the same as that soluble in citric acid.

For a soil from Agdell field, which had already been extracted twice with dilute acid, p was found to be 1.96 for hydrochloric acid, 0.06 equivalent per litre, and 0.485 for citric acid of the same acidity.

The same soil was also extracted seven times in succession with 2 per cent. sodium hydroxide, and was found to contain no phosphate soluble in dilute acid solvents. Adsorption experiments could therefore be carried out without any correction whatever. The Freundlich law was found to hold, giving a value of $p=2.22$ for hydrochloric acid and 2.08 for citric acid.

124. "Influence of the dilution of hydrogen peroxide on the velocity of precipitation of manganese from ammoniacal solutions in presence of zinc." By Andrew Jamieson Walker and Walter Farmer.

A study of the effect of dilution of the hydrogen peroxide on the accuracy of the results obtained in Jannasch's method for the separation of manganese and zinc in ammoniacal solution has shown that with a time-limit of thirty minutes precipitation of the manganese as $\text{MnO}(\text{OH})_2$ is complete with solutions of hydrogen peroxide of 2.5 per cent. strength. More concentrated solutions of the peroxide, up to 6 per cent., are equally efficacious. When the concentration is below 2.5 per cent., the manganese is not completely precipitated within the time indicated, the percentage error increasing in a marked degree with increase in the dilution. With such dilute solutions the manganese is precipitated as carbonate along with the zinc, so that under these conditions the percentage results obtained for zinc are too high. The influence of the dilution can be graphically represented by plotting curves with the percentages of hydrogen peroxide as abscissæ, and the percentage yields of mangano-manganic oxide and of zinc carbonate as ordinates.

The table gives the results obtained in a series of nine experiments. 0.4142 Gram of $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$ should give 0.1417 gram of Mn_3O_4 , and 0.4142 gram of $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$ should give 0.1806 gram of ZnCO_3 . This quantity of the salts was employed in each determination. The experimental error is much magnified by translation into percentage yield.

Percentage strength of H_2O_2 .	Mn_3O_4 . Gram.	Percentage yield of Mn_3O_4 .	ZnCO_3 . Gram.	Percentage yield of ZnCO_3 .
6.0	0.1411	99.59	0.1815	100.53
5.0	0.1410	99.51	0.1815	100.53
4.0	0.1410	99.51	0.1815	100.53
3.0	0.1410	99.51	0.1816	100.59
2.0	0.1409	99.42	0.1817	100.61
1.0	0.1381	97.51	0.1861	103.99
0.75	0.1345	94.93	0.1915	105.99
0.5	0.1297	91.56	0.1995	110.49
0.3	0.1151	81.25	0.2206	122.19

The zinc carbonate precipitated in the 6—2 per cent. separations was quite white. As the dilution was increased, it developed a distinct light-brown tint, due to the presence of manganese. Within the limits of experimental error, the deficiency in the percentage yields for manganese is balanced by the excess in the corresponding yields for zinc.

The results indicate that in the separation of manganese and zinc

in ammoniacal solution, hydrogen peroxide of not less than 2.5 per cent. strength can be employed with satisfactory results (compare Jannasch and MacGregory, *J. pr. Chem.*, 1891, [ii], **43**, 402; Jannasch and Niederhofheim, *Ber.*, 1891, **24**, 3945; Jannasch and von Cloedt, *Zeitsch. anorg. Chem.*, 1895, **10**, 405; Jannasch and Lehnert, *ibid.*, 1896, **12**, 134; Jannasch, "Gewichtsanalyse," Leipzig, 1897, 43).

125. "Additive and substitutive compounds of mercuric nitrite with organic thio-derivatives. Part I." By Prafulla Chandra Rây.

Mercuric nitrite yields with methyl and ethyl mercaptans compounds of the type $(R \cdot S \cdot HgNO_2)_2, Hg(NO_2)_2, H_2O$, where R represents an alkyl group. With the substituted carbamides it forms compounds of the general formula:



with thioacetamide and benzamide, nitrites of the type:



(R=alkyl or aryl); and with thioacetic acid a salt of the formula: $CH_3 \cdot CO \cdot SH, Hg(NO_2)_2, HgS, HgO$. The compound with thiosemicarbazide has the formula: $2NH_2 \cdot NH \cdot C(:NH) \cdot S \cdot HgNO_2, HgO, H_2O$, and that with dithiocarbamic acid $NH \cdot C(S \cdot HgNO_2)_2, HgS$.

With the thiocarbimides, also, compounds having the general formula $R \cdot N : CS \cdot Hg(NO_2)_2, 2HgS, HgO$ have been obtained; that with ethyl thioether has the formula $2Et_2S, 3Hg(NO_2)_2$. It is found that whenever a thio-compound tautomerises giving the thiol group [for example, $CH_3 \cdot CS \cdot NH_2 \rightarrow CH_3 \cdot C(SH) : NH$] the first reaction is as follows: $\cdot SH + Hg(NO_2)_2 = \cdot S \cdot HgNO_2 + NHO_2$.

126. "The reactivity of antimony haloids with various types of unsaturated compounds. Part I." By Ernest Vanstone.

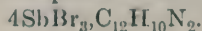
The eight binary systems formed by *s*-diphenylethane (dibenzyl), stilbene, azobenzene and benzil, and antimony trichloride and tribromide respectively have been investigated by thermal analysis.

s-Diphenylethane forms the compounds $4SbCl_3, C_{14}H_{14}$, $2SbCl_3, C_{14}H_{14}$ and $4SbBr_3, C_{14}H_{14}$.

Stilbene forms the compounds $2SbCl_3, C_{14}H_{14}$ and $2SbBr_3, C_{14}H_{14}$.

The compounds with *s*-diphenylethane are stable; those with stilbene are unstable, and difficult to obtain. The tendency is to give a thermal diagram, showing a single eutectic point.

Azobenzene forms the compounds $4SbCl_3, C_{12}H_{10}N_2$ and



These compounds can only be obtained by seeding the fused mixture with some of the compound which had been prepared previously.

Benzil does not combine with antimony haloids.

The order of diminishing reactivity with antimony haloids is *s*-diphenylethane, azobenzene, stilbene, benzil.

It was shown that the magnitude of the optical exaltation increases in the same order.

The effect of increasing the number and position of phenyl groups and also of carbonyl groups on the reactivity with antimony haloids was discussed, and shown to be in agreement with the exaltation of molecular refractive power.

In all cases conjugation diminishes the reactivity with antimony haloids and increases the exaltation.

Thermal analysis thus provides a useful method of tracing the conjugation of the residual affinity of the unsaturated atoms and groups CH⁺, N⁺, CO, with the phenyl groups in compounds of the type Ph . α . α . Ph.

127. "The absorption spectra of various substances containing two, three, and four benzene nuclei." By John Edward Purvis.

The author has carried out an investigation of substances containing two, three, and four benzene nuclei united either with simple aliphatic residues or with inorganic radicles or elements, to see how far and in what directions the vibrations of the various centres influence the absorption phenomena, and particularly as regards the effect on the benzene bands. The substances examined were: *s*- and *as*-diphenylcarbamides, *s*-dibenzylcarbamide, *s*-diphenylthiocarbamide, triphenylguanidine, phenyl diphenylcarbamate, tribenzylamine, diphenyl phthalate, triphenylacetic acid, tribenzoin, triphenylphosphine, triphenyl phosphate, tri-*o*-tolyl phosphate, tri-*p*-tolyl phosphate, and tetraphenylsilicane.

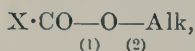
128. "Kinetics of the decomposition of acyl derivatives of phenols by means of alcohol in presence of acids and alkalis." (Preliminary note.) By Marian Jones and Arthur Lapworth.

The abstract of a paper by McCombie and Scarborough on "The velocity of saponification of the acyl derivatives of the substituted phenols" has recently appeared (this vol., p. 107). The present authors have been engaged for more than a year on certain aspects of the subject, having taken up the work primarily with the object of throwing further light on the mechanism of the acid hydrolysis of esters.

Phenyl acetate has been most closely studied, special attention having been paid to the catalytic influence of acids and alkalis on the decomposition which it undergoes in alcoholic solution. With both agents the main reaction in the first instance consists in the irreversible formation of free phenol (or alkali phenoxide) and ethyl acetate, so that complete saponification is largely the result of two successive reactions, the second being saponification of ethyl acetate complicated by the formation of phenoxide.

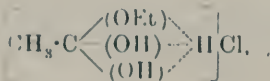
The present authors have studied only the speed at which the first reaction takes place, by estimating the amount of phenol (or phenoxide) formed after varying periods. The influence of free phenol or phenoxide in excess has also been examined. Both acids and alkalis greatly accelerate the speed of the first reaction, and the relative influence of the two types of agent is of the same order of magnitude as in the case of the hydrolysis of alkyl esters, and there is therefore no reason to suppose that the mechanism of hydrolysis is different in phenyl and alkyl esters.

As phenyl is not detached from oxygen unless under conditions of exceptional severity, it must be concluded that hydrolysis of an ester, whether by acids or alkalis, involves the severance of the molecule at the point (1), and not at (2):



and the analogy to amides and allied compounds is complete.

It is now fairly generally agreed that during hydrolysis and esterification by acid catalysts a complex (ionised or non-ionised) of catalyst and the two principal reacting components is formed which may decompose so as to yield carboxylic acid and alcohol or ester and water (and catalyst) on the other. The symmetry of the reactions, combined with all the data now available, suggests that the hydrogen atom in the "polymolecule" is labile, in the intramolecular sense, and may be regarded as influenced by all three oxygen atoms. The authors venture to suggest that the symbol



which is not inconsistent with modern views on valency, is the most satisfactory one that can at present be devised for the hypothetical complex obtained during the hydrolysis of ethyl acetate by aqueous hydrochloric acid.

The work on the kinetics of the decomposition of phenyl acetate is being continued by one of the authors (M. J.), and examina-

reaction slight decomposition often set in, with evolution of nitrogen and formation of glycol and ethylene oxide. The aqueous filtrate, on evaporation in a vacuum, gave a non-crystalline residue, which did not dissolve to a clear solution, and on evaluation by the Crum-Frankland and "urea" methods, respectively, gave, as a rule, an appreciable excess of gas by the former, proving the conversion of a certain proportion of nitrite into nitrate. In two preparations, however, the nitrogen, as estimated by both the processes, agreed well:

- (1) 0.0214 gave 2.1 c.c. N_2 ("nitritic") at 24° and 760 mm.
N=11.0.
- (2) 0.025 gave 2.6 c.c. N_2 ("nitritic") at 25° and 760 mm.
N=11.34.

The result approximates to a mononitrite, $C_2H_4(NH_2)_2 \cdot HNO_2$, which requires N("nitritic")=13.08 per cent. That the percentage of nitrogen actually found is lower is easily accounted for by the fact that there is always a slight insoluble residue.

It has already been shown (P., 1912, **28**, 258) that whilst benzyl-ethylammonium nitrite can be isolated in a crystalline form, the corresponding methyl compound decomposes even in aqueous solution, mainly into the nitroso-derivative, and that after some time equilibrium sets in, thus:



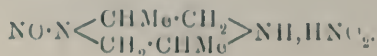
It has now been found that by using an alcoholic solution of the amine hydrochloride, this reverse change is completely arrested. The alcoholic solution, when evaporated in a vacuum over sulphuric acid, yields a crystalline mass, which is *benzylmethylammonium nitrite*:

0.0294 gave 2.46 c.c. N_2 ("nitritic") at 33° and 760 mm.
N=8.94.

$C_8H_{11}N, HNO_2$ requires N=8.33 per cent.

An alcoholic solution of piperazinium chloride, when similarly treated, gave a salt approximating to a dinitrite. It was thought that dimethylpiperazine might yield better results, and this expectation has been realised. The base chosen was α -2:5-dimethylpiperazine, which Pope and Read's recent investigations prove to have the *trans*-configuration (T., 1912, **101**, 2325; 1914, **105**, 219).

The aqueous solution of the hydrochloride, on treatment with silver nitrite and evaporation of the filtrate in a vacuum, gave a crystalline salt, which was found to be *nitrosodimethylpiperazinium nitrite*,



0.0286 gave 7.3 c.c. NO at 26° and 760 mm. by the Crum-Frankland method, whereas the "urea" test liberated only half the amount of nitrogen (compare T., 1913, **103**, 2), whence $N=14.66$.

$C_6H_{13}ON_3.HNO_2$ requires $N=14.74$ per cent.

It should be mentioned that the aqueous solution of piperazinium chloride, by treatment as above, gave dinitrosopiperazine in the first two or three crops. The introduction of the two methyl groups in the ring had the desired effect of diminishing the tendency towards the formation of the nitroso-derivative.

Dimethylpiperazinium chloride in alcoholic solution was next treated with finely powdered silver nitrite. Although both the reacting substances are very sparingly soluble in alcohol, the increased solubility of silver nitrite in the presence of an amine nitrite (due, no doubt, to the formation of a double salt) facilitates the double decomposition. The alcoholic filtrate was evaporated in a vacuum, and the crystalline salt which was thus obtained was found to be a *dinitrite*, as both by the Crum-Frankland and the "urea" process it yielded the same amount of nitrogen:

0.023 gave 2.7 c.c. N_2 ("nitritic") at 30° and 760 mm. $N=13.33$.

0.0764 (by combustion) gave 18.0 c.c. N_2 at 26° and 760 mm.

$N=26.41$.

$C_6H_{14}N_2.2HNO_2$ requires N ("nitritic") = 13.46, and N (total) = 26.92 per cent.

Conductivity measurements also bear out that the one is the nitrite of a nitroso-derivative and the other a dinitrite (compare T., 1912, **101**, 1555).

Nitrosodimethylpiperazinium nitrite:

V	252.1	504.2	1008.4	2016.8
μ	93.5	102.7	114.3	120.7

In this case there are only two univalent ions.

Dimethylpiperazinium dinitrite:

V	200.3	400.6	801.4	1602.4
μ	210.3	225.4	237.2	241.1

Evidently there are three ions in solution. The measurements were conducted at 25°.

132. "Partially methylated glucoses. Part III. Monomethyl glucose." By James Colquhoun Irvine and Thomas Percival Hogg.

Monomethyl glucose has been prepared from glucosediacetone on a sufficiently large scale to permit of the α - and β -modifications being isolated in pure stereochemical forms. As the inter-

conversion $\alpha \rightleftharpoons \beta$ proceeds extremely slowly in pure methyl alcohol, it has been possible to determine the initial specific rotation of each form of the sugar with a high degree of accuracy. The mutarotatory changes observed were:

α -Form (m. p. 160.5—161°). β -Form (m. p. 133.5—135°).
Initial $[\alpha]_D + 107.6^\circ \rightarrow \underline{68.5^\circ, 68.3^\circ} \leftarrow + 24.4^\circ$ initial $[\alpha]_D$.

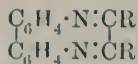
The difference of the molecular rotations of the α - and β -forms thus equals 16141, and as the corresponding value for glucose is 16200, the result agrees with Hudson's rule (*J. Amer. Chem. Soc.*, 1909, **31**, 66) within the limits of experimental error.

It has been found that monomethyl glucose yields few characteristic derivatives, and its methylglucosides, in view of the spatial distribution of the hydroxyl groups, fail to enter into condensation with either acetone or benzaldehyde. A well-defined *monomethyl glucoseanilide* was, however, isolated (m. p. 154—155°). This compound shows suspended mutarotation in a remarkable degree, and the optical change $[\alpha]_D - 108.5^\circ \rightarrow -50.3^\circ$ was only promoted by traces of acids, and not by alkalis.

The constitution previously assigned to monomethyl glucose has been confirmed, as, on oxidation with nitric acid, the sugar is converted into *monomethyl gluconolactone*, thus indicating that the methoxyl group is attached to a terminal carbon atom. The sugar is not fermented by living yeast, or by yeast extract, and is unaffected by most bacteria which attack glucose. The action of *B. Cloacae* (Jordan), however, resulted in the formation of both acid and gas, but the reaction proceeded much more slowly than in the case of glucose.

133. "Studies in the diphenyl series. Part VI. The configuration of diphenyl and its derivatives." By John Cannell Cain and Frances Mary Gore Micklethwait.

It has been found that benzidine and tolidine condense with reagents for ortho-diamines, such as benzil and glyoxal, to form compounds of the type



(where R = H or C_6H_5).

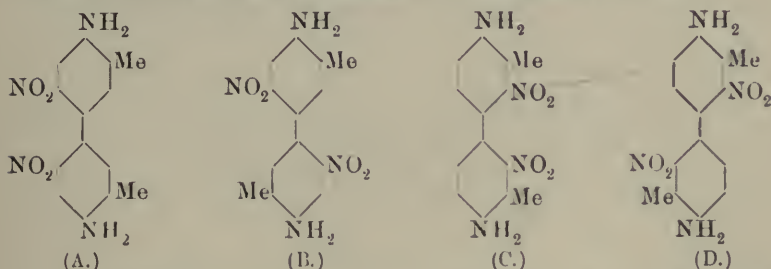
This reaction appears to prove that Kaufler's stereochemical configuration of members of the diphenyl series is correct.

134. "Studies in the diphenyl series. Part VII. Isomeric *o*- and *m*-dinitro-*o*-tolidines." By John Cannell Cain and Frances Mary Gore Micklethwait.

In addition to the *o*-dinitrotolidine (m. p. 270°) described by Gerber, the authors have obtained, by the nitration of diacetyl-tolidine, a new isomeric *o*-dinitrotolidine (m. p. 202—203°).

By the nitration of tolidine sulphate or diphtalyltolidine there are formed, in addition to Gerber's *m*-dinitrotolidine (m. p. 217°; obtained by him from tolidine sulphate), three new *m*-dinitrotolidines, melting at 205—206°, 263°, and 284° respectively.

These four bases are represented by the plane formulæ:



and the possibility of the separate existence of A and B and of C and D, as well as of the two isomeric *o*-dinitrotolidines, is readily explained by means of Kaufler's stereochemical formula for diphenyl.

135. "Thio-derivatives of β -naphthylamine."

By William Reeve and Samuel Smiles.

The substances here described were obtained in some experiments which had been undertaken with the object of synthesising $\alpha\beta$ -naphthathiophen. The results are now published, since the scheme has been abandoned on account of the extremely poor yields of the essential products.

Dimethyl- β -naphthylamine sulphide, $\text{NMe}_2 \cdot \text{C}_{10}\text{H}_6 \cdot \text{S} \cdot \text{C}_{10}\text{H}_6 \cdot \text{NMe}_2$, was obtained by treating three molecular proportions of dimethyl- β -naphthylamine dissolved in light petroleum with one molecular proportion of sulphur chloride. The insoluble hydrochloride of dimethyl- β -naphthylamine separated, and when this had been removed the required substance was isolated by spontaneous evaporation of the solution. After recrystallisation from hot alcohol, it was obtained in very pale yellow needles, which melted at 145°:

Found, S=8.4. N=7.2.

$\text{C}_{24}\text{H}_{24}\text{N}_2\text{S}$ requires S=8.6; N=7.5 per cent.

Di-β-naphthylamine sulphide, $\text{NH}_2 \cdot \text{C}_{10}\text{H}_6 \cdot \text{S} \cdot \text{C}_{10}\text{H}_6 \cdot \text{NH}_2$, was obtained by treating β -naphthylamine in nitrobenzene solution at 160° with sulphur in the presence of lead oxide. The solvent was removed in a current of steam, and the residue was dissolved in acetic acid. Water was then added to this solution, and the amorphous precipitate which separated was collected and dissolved in ether. By spontaneous evaporation of the solvent the sulphide was deposited in an impure condition. It separated from solution in hot alcohol in colourless needles, which melted at 166° :

Found, S=10.0 and 9.8. N=8.6 and 8.7.

$\text{C}_{20}\text{H}_{16}\text{N}_2\text{S}$ requires S=10.1; N=8.86 per cent.

When dissolved in hot aqueous mineral acids, the substance was readily oxidised by atmospheric oxygen, an insoluble, blue material being formed.

The yield of the sulphide obtained by this method varies considerably, not only according to the quantity of the reagents taken, but also according to other conditions, which have not yet been determined. In the majority of experiments the yield was extremely poor, and in these cases it is difficult to separate the substance from the polysulphides which are always formed. These compounds—the di- and tri-sulphides—have not been closely examined.

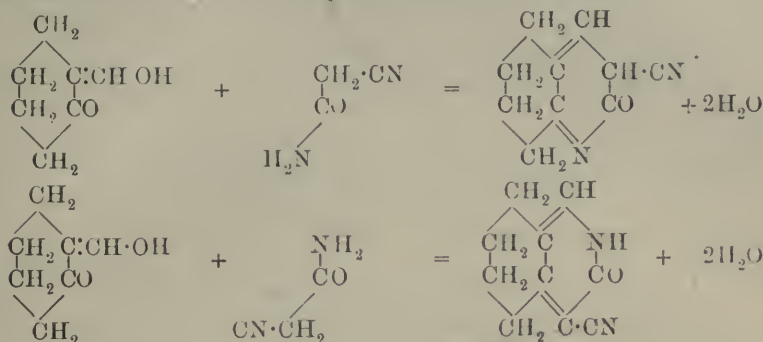
136. "The interaction of naphthasulphonium-quinone and substances containing the thiol group." By Brojendranath Ghosh and Samuel Smiles.

A description was given of the reaction of certain thiol derivatives with β -naphthaquinone and β -naphthasulphonium-quinone. From the last-named quinone, thiol and thioglycolyl derivatives of dinaphthathioxin were obtained. The action of alkali with these substances and with hydroxydinaphthathioxin was examined in order to determine whether isomeric change could be induced, as in the case of the *isosulphide* of β -naphthol. The results were negative.

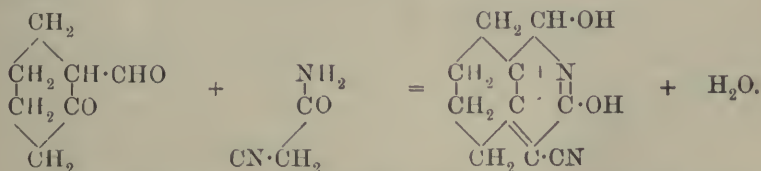
137. "The formation of heterocyclic compounds from hydroxymethylene ketones and cyanoacetamide." (Preliminary note.) By Hemendra Kumar Sen-Gupta.

Hydroxymethylene-ketones condense readily with cyanoacetamide in the presence of piperidine or diethylamine, giving rise to heterocyclic compounds; in the case of open-chain hydroxymethylene-ketones, hydroxypyridine derivatives are obtained, whilst with

hydroxymethylene-*cycloketones*, substances are produced which may be either quinoline or *isoquinoline* derivatives, according as to whether the condensation commences at the formyl carbon atom or the ketonic carbonyl of the hydroxymethylene compound.



In addition to these condensation products which are formed by the elimination of two molecules of water, there is evidence of the formation of a second type in which only one molecule of water is eliminated:



In some cases, this intermediate type has been isolated by careful crystallisation. Since a well-defined acid is obtained by hydrolysing either of the condensation products thus produced, there is little doubt as to the similarity of their structures. In a few cases the final products which are deposited from the condensing mixture have been found to be those condensation products which have lost two molecules of water.

The following compounds have been obtained:

- (1) Ethyl hydroxymethylene-ethyl ketone,
 $\text{C}_2\text{H}_5 \cdot \text{CO} \cdot \text{C}(\text{CH}_3) \cdot \text{CH} \cdot \text{OH}$,

gives with cyanoacetamide a mixture of condensation products which, on hydrolysing, yields an *acid*, $\text{C}_9\text{H}_{11}\text{O}_3\text{N}$ (m. p. 278—279°); this evolves carbon dioxide on melting, and passes into the *compound*, $\text{C}_8\text{H}_{11}\text{ON}$ (m. p. 136—138°).

(2) Hydroxymethylenecyclohexanone yields the condensation products $\text{C}_{10}\text{H}_{10}\text{ON}_2$ (m. p. 250°) and $\text{C}_{10}\text{H}_{12}\text{O}_2\text{N}_2$ (melting above 300°). Both *compounds*, on hydrolysis with 80 per cent. sulphuric acid, give the same *acid*, $\text{C}_{10}\text{H}_{11}\text{O}_3\text{N}$ (m. p. 265°), which evolves

carbon dioxide on melting, and passes into the *compound*, $C_9H_{11}ON$ (m. p. 204°).

(3) 2-Methylhydroxymethylenecyclohexanone gives the *compound*, $C_{11}H_{12}ON_2$ (m. p. 242°), which, on hydrolysis, yields the *acid*, $C_{11}H_{13}O_3N$ (m. p. 260°); this loses carbon dioxide, and forms the *compound*, $C_{10}H_{13}ON$ (m. p. 142°).

(4) 4-Methylhydroxymethylenecyclohexanone gives the *compound*, $C_{11}H_{12}ON_2$ (m. p. $228-229^\circ$), which is hydrolysed to the *acid*, $C_{11}H_{13}O_3N$ (m. p. 284°), and the latter yields the *compound*, $C_{10}H_{13}ON$ (m. p. $206-207^\circ$), with loss of carbon dioxide.

Experiments with the object of elucidating the constitution of this class of compounds are in progress.

138. "Studies of ammonium solutions." A correction.

By Roland Edgar Slade.

In a former communication it was shown that the potential of an ammonium electrode at 25° was given by the equation:

$$e = e_0 - 0.059 \log \frac{p_{NH_3} p_{H_2}^{\frac{1}{2}}}{[NH_4^+]}$$

The value of e_0 was calculated to be -0.486 volt from twelve independent measurements. It has been pointed out to the author by Prof. Auerbach that, in calculating these values of e_0 , the pressures of ammonia were, by mistake, expressed in mm. of mercury instead of in atmospheres. This mistake has now been corrected, and the values have been revised in accordance with the later value for the potential of the normal hydrogen electrode. The revised value of e_0 is -0.654 volt.

This value has been compared with other data, and found to be in excellent agreement.

139. "Thujin." By Arthur George Perkin

Rochleder and Kawalier (*Wien. Akad. Ber.*, 1858, **29**, 10; *J. pr. Chem.*, 1858, **74**, 8) isolated from the arbor vitæ (*Thuja occidentalis*) in minute amount a glucoside, thujin, $C_{20}H_{22}O_{12}$, which by hydrolysis yielded dextrose and thujigenin, $C_{14}H_{12}O_7$, the latter subsequently passing into thujetin, $C_{14}H_{14}O_8$. Thujigenin and thujetin are described as yellow, crystalline substances, soluble in alkalis with a green colour, and in alcoholic ammonia with a bluish-green coloration. A re-examination has now shown that thujin is, in reality, quercitrin contaminated with a trace of a second glucoside, and that the green tint of the alkaline solution of the free colouring matter originates from the latter compound. It is possibly a glucoside of myricetin (T., 1899, **75**, 829), but the

amount present in the material now examined was far too small for identification. Incidentally, it has been found that quercitrin melts at 183—185°, much higher than has been usually supposed (compare Herzig, *Monatsh.*, 1885, 6, 877), that the formula $C_{21}H_{22}O_{12}$, assigned to it previously, which it is found to possess when dried in the air or at 100°, is, in reality, $C_{21}H_{20}O_{11}, H_2O$, and that it may be obtained in the anhydrous condition when heated at 160°.

140. "The rotatory powers of *d*- and *l*-isoamarine and of their respective tartrates." By Henry Lloyd Snape.

In a previous paper on "Racemic and optically active forms of amarine" (T., 1900, 77, 784; see also this vol., p. 7), the density was inadvertently omitted in the calculation of rotatory powers. Redeterminations were subsequently made, and the missing factor was included. As before, the bases were dissolved in ethyl acetate, and the tartrates in 90 per cent. alcohol.

Each determination of the angle of rotation was made by taking the average of a number of rotations (which fluctuated slightly and irregularly—sometimes falling and then rising, and sometimes conversely) measured at the same time on successive days. The following are the results obtained:

	<i>c.</i>	$[\alpha]_D$	Number of determinations
Dextro-base ($C_{21}H_{18}N_2$)	4.500	+ 69.06	3
Lævo-base	4.581	- 68.23	2
Dextro-tartrate of dextro-base..	1.357	+ 113.95	2
„ lævo-base...	3.377	- 93.31	3

As the only polarimeter which was at the author's disposal for the above experiments was a very simple one, and could not be trusted to give very exact measurements, Professor W. J. Pope very kindly undertook to determine $[\alpha]$ in specimens of the dextro-tartrates of *d*- and *l*-isoamarine, and the following are his results, for which the author desires to express his thanks.

In each of the following determinations the quantity of the substance stated was dissolved at 20°, made up to 30 c.c., and the solution examined in a 4-dcm. tube at 20°.

d-isoAmarine *d*-tartrate, 0.9053 gram in absolute alcohol.

	Hg violet.	Hg green.	Hg yellow.	Na yellow.
α	+ 32.57°	+ 16.56°	+ 14.18°	+ 13.48°
$[\alpha]$	+ 270	+ 137	+ 117	+ 112

Rotatory dispersions, $Hg_{violet}/Na_{yellow} = 2.416$; $Hg_{green}/Na_{yellow} = 1.228$;
 $Hg_{yellow}/Na_{yellow} = 1.052$.

0.3097 in 90 per cent. alcohol by weight.

	+ 12.34°	+ 6.29°	+ 5.38°	+ 5.12°
α				
$[\alpha]$	+ 299	+ 152	+ 130	+ 124

Rotatory dispersions, 2.410, 1.229, and 1.051 respectively.

l-isomarine d-tartrate, 0.2390 gram in absolute alcohol.

α_{D}	- 7.55°	- 3.68°	- 3.15°	- 3.07°
$[\alpha]$	- 237	- 115	- 98.8	- 96.3

Rotatory dispersions, 2.459, 1.199, and 1.026 respectively.

It will be observed that the corrected values for the *D* line for the tartrate of the dextro-base in 90 per cent. alcohol is 124, which is distinctly higher than was obtained with the imperfect apparatus. Similarly, the value for the tartrate of the lævo-base in absolute alcohol is somewhat higher than was obtained from a solution in 90 per cent. alcohol. Probably, therefore, the values given above for the bases are, like those cited in the same table for the tartrates, only approximately correct.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Barger, George. The simpler natural bases. London 1914. pp. vii + 215. 6s. net. (*Recd.* 30/4/14.)

From the Publishers: Messrs. Longmans, Green & Co.

Dunstan, Albert Ernest, and Thole, Ferdinand Bernard. The viscosity of liquids. London 1914. pp. viii + 91. 3s. net. (*Recd.* 31/3/14.)

From the Publishers: Messrs. Longmans, Green & Co.

Hilditch, Thomas Percy. A third year course of organic chemistry. The heterocyclic compounds, carbohydrates, and terpenes. London 1914. pp. xii + 411. 6s. (*Recd.* 25/3/14.)

From the Publishers: Messrs. Methuen & Co., Ltd.

Imperial Institute. Selected reports from the Scientific and Technical Department. I—V. London 1909–1914. (*Recd.* 28/4/14.)

Reports on the results of Mineral Surveys in Ceylon, Southern Nigeria, Northern Nigeria, and Nyasaland. London 1905–1913. (*Recd.* 28/4/14.)

From the Director.

Jones, Walter. Nucleic acids. Their chemical properties and physiological conduct. London 1914. pp. viii + 118. 3s. 6d. net. (*Recd.* 30/4/14.)

From the Publishers: Messrs. Longmans, Green & Co.

Lagache, Henri. De l'apprêt des tissus de laine peignée. Paris 1914. pp. viii + 438. ill. 18 fr. (*Recd.* 4/5/14.)

From the Publishers: MM. H. Dunod et E. Pinat.

Pickard, Joseph Allen. Modern steel analysis. A selection of practical methods for the chemical analysis of steel. London 1914. pp. viii + 128. ill. 3s. 6d. net. (*Recd.* 2/4/14.)

From the Publishers: Messrs. J. & A. Churchill.

II. *By Purchase.*

Caspari, William Augustus. India-rubber laboratory practice. London 1914. pp. viii + 196. ill. 5s. net. (*Recd.* 24/3/14.)

Deutsche Chemische Gesellschaft. Literatur-Register der organischen Chemie geordnet nach M.M. Richter's Formelsystem Edited by *Robert Stelzner*. Vol. I. 1910-1911. Braunschweig 1913. pp. xl + 1286. (*Reference.*)

Grossmann, H. Die Bestimmungsmethoden des Nickels und Kobalts und ihre Trennung von den anderen Elementen. (Die chemische Analyse, Vol. XVI.) Stuttgart 1913. pp. 140. M.5.—. (*Reference.*)

Sheppard, Samuel Edward. Photo-chemistry. London 1914. pp. xii + 461. ill. 12s. 6d. (*Recd.* 6/3/14.)

Smith, Ernest A. The sampling and assay of the precious metals: comprising gold, silver, platinum and the platinum group metals in ores, bullion, and products. London 1913. pp. xv + 460. ill. 15s. net. (*Recd.* 11/2/14.)

Soddy, Frederick. The chemistry of the radio-elements. Part II. The radio-elements and the periodic law. London 1914. pp. iv + 46. ill. 2s. net. (*Recd.* 6/1/14.)

Stähler, Arthur. Handbuch der Arbeitsmethoden in der anorganischen Chemie. Vol. III, Part 1. Leipzig 1913. pp. x + 692. ill. M.25.—. (*Reference.*)

Thomson, Sir Joseph John. Rays of positive electricity and their application to chemical analyses. London 1913. pp. viii + 132. ill. 5s. net. (*Recd.* 13/3/14.)

Vanino, Ludwig. [Editor.] Handbuch der präparativen Chemie. Vol. I. Anorganischer Teil. Stuttgart 1913. pp. xx + 670. ill. M.18.—. (*Recd.* 13/3/14.)

Wölbling, H. Die Bestimmungsmethoden des Arsens, Antimons und Zinns und ihre Trennung von den anderen Elementen. (Die chemische Analyse, Vols. XVI and XVII.) pp. 377. M.13.—. (*Reference.*)

THE FARADAY LECTURE.

The Faraday Lecture, entitled "Electrolytic Dissociation," will be delivered by Professor Dr. Svante Arrhenius, F.R.S., on Monday, May 25th, at 6 p.m. The Lecture will be given, by the kind permission of the Managers, in the theatre of the Royal Institution, 21, Albemarle Street, W.

Admission will be by ticket only. Each Fellow of the Society is entitled to two tickets, which may be obtained on application to the Assistant Secretary, Chemical Society, Burlington House, W.

RESEARCH FUND.

A meeting of the Research Fund Committee will be held in June next. Applications for grants, to be made on forms which can be obtained from the Assistant Secretary, must be received on or before Monday, June 1st, 1914.

All persons who received grants in June, 1913, or in June of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be in the hands of the Honorary Secretaries by June 1st.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is applied to investigations relating to problems connected with the coal-tar and allied industries.

At the next Ordinary Scientific Meeting, on Thursday, **May 21st**, 1914, at 8 30 p.m., the following papers will be communicated:

"Ionisation and the law of mass action. Part III. Utilisation of the osmotic data and a new dilution law." By W. R. Bousfield.

"The influence of nitro-groups on the reactivity of substituents in the benzene nucleus." By J. Kenner.

"Some indazole derivatives." By R. Curtis and J. Kenner.

"The viscosity of sugar solutions." By H. Green.

"Compounds of phenanthraquinone with metallic salts." By J. Knox and H. R. Innes.

"Quinone-ammonium derivatives. Part III. Dihaloid, mono-azo-, bisazo-, nitrotriazole-, and bistriazole-compounds. Attempts to prepare derivatives containing an asymmetric, quinquivalent nitrogen atom." By R. Meldola and W. F. Hollely.

ERRATA.

PROCEEDINGS, 1914.

Page.	Line.	
6	2	for "Arthur James Meads" read "John Arthur Meads."
35	16	„ " $\frac{dP}{dx}$ " read " $\frac{dP}{dy}$ ".

PROCEEDINGS

OF THE

CHEMICAL SOCIETY.

Vol. 30

No. 430.

Thursday, May 21st, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT announced that in connection with the Van't Hoff Memorial a Fund has been established for the endowment of research in the field of Pure and Applied Chemistry. The amount available during 1915 for purposes of research is about £67.

A Committee consisting of Professor A. F. Holleman (President), Professor S. Hoogewerff, Professor A. Smits, and Professor F. M. Jaeger (Secretary), has been appointed to award grants. Applications for grants should be sent before November 1st, 1914, by registered post to "Het Bestuur der Koninkklyke Akademie van Wetenschappen; bestemd voor de Commissie van het 'Van't Hoff-fonds' Trippenhuis, Kloveniersburgwal, te Amsterdam," and applicants are requested to submit a detailed account of the manner in which they propose to spend the grant.

Papers embodying the results of the Research may be published in any Journal, but acknowledgment must be made of the source of the grant. Copies of the papers embodying the results of the Research must be forwarded to the Committee.

Messrs. L. J. Hudlestone, A. U. Newton, B. N. Ghosh, T. E. Hodges, G. P. Furneaux, A. Coulthard, A. Baxter, R. O. Bishop, and S. M. Bosworth, were formally admitted Fellows of the Chemical Society.

Certificates were read for the first time in favour of Messrs:

Frederick George Henderson, 44, Dene View, Wallsend-on-Tyne.

Victor Henri, 8, Rue du Puits de l'Ermite, Paris.

Robert Ernest Machin, B.Sc., 5, Redcliffe Road, South Kensington, S.W.

Thomas William Thompson, M.A., Queen Elizabeth's Grammar School, Gainsborough.

A Certificate has been authorised by the Council for presentation to ballot under Bye-Law I. (3) in favour of Mr. Probodha Chundra Chattopadhyay, M.A., 90, Maniktala Main Road, Harrison Road P.O., Calcutta.

Of the following papers, those marked * were read:

***141. "Ionisation and the law of mass action. Part III.**

Utilisation of the osmotic data and a new dilution law."

By William Robert Bousfield, K.C.

Excellent freezing-point and vapour-pressure data for concentrated solutions of lithium chloride exist, and less complete data for sodium and potassium chlorides, the vapour-pressure data ranging from 40° to 100°. An empirical vapour-pressure formula of the form

$$h\delta p/p = 2 - Gh^{-\frac{1}{2}} + Ah^{-1} - Bh^{-\frac{3}{2}}$$

is found, which gives expression to the data obtained by extrapolation to 18°.

A new dilution law is proposed of the form

$$\frac{\alpha^2}{1-\alpha} = K(h-n)^{\frac{1}{2}}$$

By using this in conjunction with the osmotic relations

$$\frac{P}{R'T'} = \frac{\Delta}{R''} = \frac{\delta p}{p} = \frac{1+\alpha}{h-n},$$

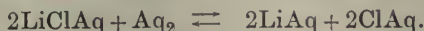
it is possible to evaluate both α and n .

The values of α and n independently obtained from the freezing-point and vapour-pressure data are found to be in good accord, and give values for n at infinite dilution which are in fair accord with those derived from conductivities.

With the more complete series of data for lithium chloride, it is found that a relation exists between α and n which is independent of temperature in the range considered, namely, $n = 38\alpha - 14$.

This enables the conditions of a saturated solution of lithium

chloride at 18° to be examined, which shows that the ionisation reaction may be taken to be



This gives, according to the law of mass action, the relation

$$\frac{\alpha^4}{(1-\alpha)^2} = K' \frac{\beta}{2} (h-n),$$

where β is the weight fraction of the free water, $h-n$, which exists in the form Aq_2 , or dihydrol.

This is identical with the assumed dilution law,

$$\frac{\alpha^2}{1-\alpha} = K(h-n)^{\frac{1}{2}},$$

if

$$K = \sqrt{K'\beta/2}.$$

It is shown by reference to the figures for α , n , and β that the relation holds, and that K' has the same value both at infinite dilution and in saturated solutions of lithium chloride.

Alternatively, the reaction might be taken to be

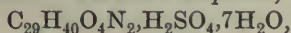


which leads also to the form of the dilution law.

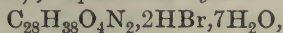
*142. "The alkaloids of ipecacuanha."

By Francis Howard Carr and Frank Lee Pyman.

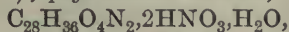
A detailed description was given of an investigation of which a part has previously been reported in a preliminary note (P., 1913, 29, 226). The salts of emetine, cephaeline, and psychotrine have been fully characterised. *Emetine sulphate*,



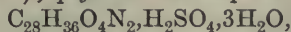
m. p. 205—245° (corr.); *cephaeline hydrobromide*,



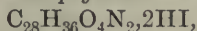
m. p. 266—293° (corr.); *psychotrine nitrate*,



m. p. 184—187° (corr.); *psychotrine sulphate*,



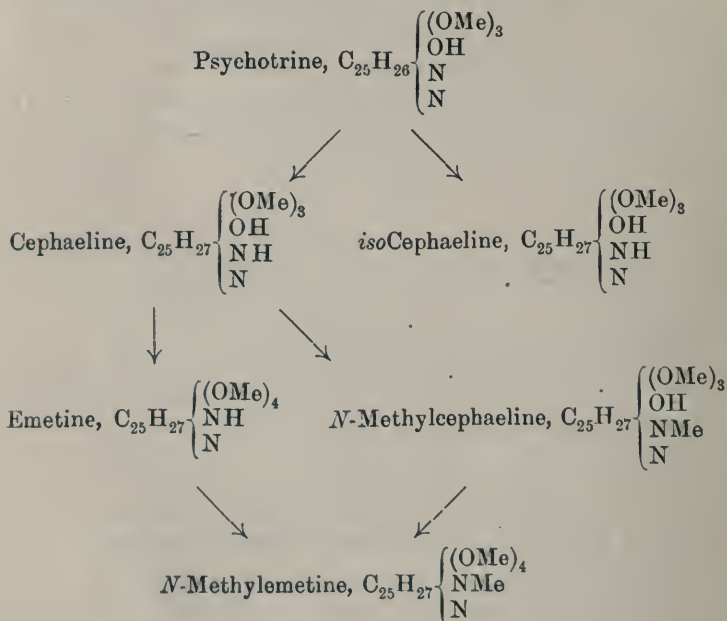
m. p. 214—217° (corr.); and *psychotrine hydriodide*,



m. p. 222° (corr.), are new crystalline salts.

In correction of the previous statement it was shown that emetine and cephaeline are secondary-tertiary bases. Emetine yields a crystalline *N-benzoyl* derivative, $\text{C}_{29}\text{H}_{39}\text{O}_4\text{N}_2 \cdot \text{COPh}$, m. p. 185—186° (corr.), which is a monacidic tertiary base. Emetine is the *O*-methyl ether of cephaeline. It gives *N-methylemetine*, an amorphous base yielding crystalline salts, on methylation. Cephaeline

yields on methylation a mixture of emetine, *N*-methylcephaeline, m. p. 194—195° (corr.), and *N*-methylemetine. Psychotrine has the formula $C_{25}H_{36}O_4N_2 \cdot 4H_2O$, and yields on reduction a mixture of cephaeline and isocephaeline (m. p. 159—160° [corr.]). The relation between these alkaloids can be expressed as follows:



The hydrochlorides obtained by the oxidation of cephaeline with ferric chloride were shown to have the formulæ $C_{18}H_{15}O_3NCl \cdot HCl$ and $C_{20}H_{27}O_3NCl_2 \cdot HCl$ respectively.

143. "The viscosity of sugar solutions."

By Heber Green.

In a recent paper Powell (T., 1914, 105, 1) claims that the relation between the viscosity and concentration of sugar solutions can be expressed by the equation $\eta_x = \eta_0 A^x$, where x is the ratio of solute to solvent, and in his discussion of previous work quotes the present author (Green, T., 1908, 93, 2027) as having concluded that "the connexion between viscosity and concentration is not accurately expressed, even within the limits of experimental error, by any of the various formulæ that have been suggested."

This is, however, an incomplete quotation, the continuation of the same sentence being to the effect that the best concordance is

obtained by the use of an expression of the form $\eta_x = \eta_0 A^{v/w}$, where v and w are the volumes of the solute and solvent respectively.

It was shown that the form of this expression supported by Powell merely neglects any possible contraction which may occur when the sucrose dissolves in water and is not that which gives the nearest approach to accuracy.

The discrepancies between the calculated and observed viscosities are, in any case, far beyond the experimental error of the measurements made by the present author more than five years ago, and he sees no reason to alter the conclusion arrived at then.

144. "Compounds of phenanthraquinone with metallic salts."

By Joseph Knox and Helen Reid Innes.

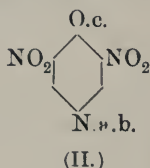
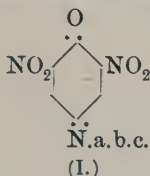
The following additive compounds of phenanthraquinone and metallic salts have been prepared and analysed: $C_{14}H_8O_2 \cdot ZnBr_2$, $(C_{14}H_8O_2)_2 \cdot ZnI_2$, $C_{14}H_8O_2 \cdot CdCl_2$, $C_{14}H_8O_2 \cdot CdBr_2$, $C_{14}H_8O_2 \cdot CdI_2$, $(C_{14}H_8O_2)_2 \cdot HgBr_2$.

The relative stability of the zinc and cadmium compounds has been determined by finding the concentration of metallic haloid in aqueous solution with which mixtures of phenanthraquinone and the various double compounds are in equilibrium. This equilibrium concentration is a measure of the relative stability. The lower the equilibrium concentration, the greater is the stability of the compound. It has been found that with a given metal the iodide compound is more stable than the bromide, and the bromide than the chloride, whilst the cadmium compounds are more stable than the corresponding zinc compounds. The stability of the compounds, therefore, increases with diminishing electro-affinity of both the metal and the halogen. The mercuric compounds are more stable than either the zinc or the cadmium compounds, as is shown by their behaviour towards water, and mercury is the metal of weakest electro-affinity of the sub-group. The greater complexity of the mercuric compounds compared with the zinc and cadmium compounds, and of the zinc iodide compound compared with the zinc chloride and bromide compounds, also illustrates the increasing tendency to complex-formation with diminishing electro-affinity.

145. "Quinone-ammonium derivatives. Part III. Dihaloid, monoazo-, bisazo-, nitrotriazole-, and bistriazole-compounds: attempts to prepare derivatives containing an asymmetric, quinquevalent nitrogen atom." By Raphael Meldola and William Francis Hollely.

Taking advantage of the partial and complete reducibility of the nitro-groups in 2:6-dinitro-4-trimethylammonium-1-benzoquinone

(T., 1912, **101**, 912; 1913, **103**, 177), the authors have prepared a number of new quinone-ammonium derivatives containing naphtholazo- and triazo-groups in place of one or both of the original nitro-groups. The constitution of the 2:6-dibromo-derivative (T., 1913, **103**, 185) has been proved directly by synthesis from 2:6-dibromo-*p*-aminophenol. Systematic attempts to obtain a quinone-ammonium compound of the type (I) with three dissimilar radicles attached to the nitrogen atom have led



to the discovery that this nitrogen atom appears to be incapable of carrying three different radicles when the weight or size of the latter exceeds some limit at present undetermined. If this limit is exceeded, the alkylation apparently takes a normal course, in spite of steric hindrance, and the isomeric phenolic ether (II) is obtained.

146. "The estimation of carbon monoxide."

By Joseph Ivon Graham and Thomas Field Winmill.

As is well known, carbon monoxide is oxidised to carbon dioxide by iodine pentoxide, and various methods of estimating carbon monoxide have been described, based on this reaction. The authors have studied the temperature at which the reaction takes place, and the influence of other gases on its course. A modified form of Haldane's gas-analysis apparatus was described, in which the oxidation may be carried out rapidly, and carbon monoxide estimated with an accuracy of 0.02 per cent.

147. "Alcoholometry and rational fractionation."

By Hendrik Pieter Barendrecht.

A new distilling apparatus, made from copper, was described, which allows the estimation of alcohol in a fermented liquid, containing between 2 and 3 per cent. of alcohol, by concentrating automatically and in one operation all the alcohol in one-twentieth of the original volume. By this arrangement accuracy is easily obtained, even in using an alcoholometer. From very weak solutions, for example, 0.01 per cent., all the alcohol may be distilled off at once in the hundredth-part of a sample of 3 litres.

The construction of this apparatus, as well as of another one (also described), made out of ordinary laboratory glassware, is based on the following principle.

The rectifier, surrounded on the top by an open water-reservoir as a dephlegmator, should have a large volume, filled with a porous substance, to store up and concentrate the volatile liquid, until all of the latter has been boiled out of the sample, and has thereby heated the dephlegmator so far that the liquid can pass to the condenser.

148. "The resolution of 5-nitrohydrindene-2-carboxylic acid." By William Hobson Mills, Horace Victor Parker, and Robert William Prowse.

With the object of obtaining an optically active benzene derivative in which it should be necessary to take into consideration the relative distribution in space of the substituent groups to account for the optical activity, the authors have prepared 5-nitrohydrindene-2-carboxylic acid, $\text{NO}_2 \cdot \text{C}_6\text{H}_3 \begin{smallmatrix} \text{CH}_2 \\ \text{CH}_2 \end{smallmatrix} \text{CH} \cdot \text{CO}_2\text{H}$, and have shown that it can be resolved by means of its quinine salt into two antimeric components. Unless the configuration of the nitrophenylene radicle is taken into account, the reason for the molecular asymmetry of this compound does not appear. It is evidently due to the asymmetrical disposition of the nitro-group with respect to the two methylene groups, it being in the meta-position to one and in the para-position to the other.

149. "Researches on pseudo-bases. Part I. Some condensation reactions of cotarnine, hydrastinine, and isoquinoline methyl hydroxide." By Gertrude Maud Robinson and Robert Robinson.

Cotarnine condenses with 6-nitrohomoveratrole, nitrohomopiperonyl alcohol, or nitropiperonal to yield nitrohomopiperonyl-, nitropiperonylidene-, or nitropiperonoyl-hydrocotarnine respectively. The condensation of isoquinoline methyl hydroxide with 6-nitrohomoveratrole, and of hydrastinine with itself, was also described.

150. "Molecular conductivities of iodoanilinesulphonic acids." By Mary Boyle.

The following monoiodoanilinesulphonic acids have been prepared and the conductivities of their aqueous solutions at 25°

determined: 2-, 3-, and 4-iodoaniline-6-sulphonic acids, 2-, 3-, and 4-iodoaniline-5-sulphonic acids, and 2- and 3-iodoaniline-4-sulphonic acids. In all cases where iodine is introduced into an ortho-position to the amino-group, a very considerable increase in molecular conductivity occurs; the increase is much less marked in the case of *m*- and *p*-iodo-substituted acids.

151. "The action of steam on sodium chloride." (Preliminary note.)
By Solomon English and William Ernest Stephen Turner.

Some years ago Emich (*Ber.*, 1907, **40**, 1482) described an experiment in which the production of hydrogen chloride from salt and water was demonstrated by dropping water on sodium chloride heated in a platinum crucible. Another and simpler way of demonstrating the reaction is to drop a solution of salt on the surface of a platinum basin at bright-red heat, when not only hydrogen chloride can be detected in the issuing vapour but the residue is distinctly alkaline.

The authors have attempted to determine the extent to which this hydrolytic decomposition occurs by passing steam over sodium chloride in a platinum boat heated to varying temperatures. There is no appreciable action at and below 500°, but it becomes recognisable at 700°, and increases steadily with rise of temperature, measurements having been made up to 1000°. Sodium chloride possesses an appreciable vapour pressure below its melting point (800°), and the reaction appears to take place mainly between the salt vapour and steam. In porcelain tubes, however, the amount of hydrogen chloride found exceeds the alkali left as residue, and so far the authors have been unable to trace the reason for the discrepancy. They hope to repeat the determinations in a platinum tube.

152. "Experiments on the synthesis of the benzoterpenes. Part I. Derivatives of benzonor-*p*-menthane." By Francis William Kay and Allan Morton.

An account was given of the synthesis of some representatives of a new class of terpenes, described as the *benzoterpenes*, which have been obtained from the various derivatives of α -naphthoic acid with the aid of Grignard's reagent.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Brame, John Samuel Strafford. Fuel. Solid, liquid and gaseous. London 1914. pp. xv + 372. ill. 12s. 6d. net. (*Recd.* 20/4/14.)

From the Author.

Bucherer, Hans Theodor. Lehrbuch der Farbenchemie, einschliesslich der Gewinnung und Verarbeitung des Teers, sowie der Methoden zur Darstellung der Vor- und Zwischenprodukte. Leipzig 1914. pp. xii + 557. M.22.—. (*Recd.* 21/4/14.)

From the Publisher: Otto Spamer.

The Chemical News and Journal of Physical Science. A journal of practical chemistry in all its applications to pharmacy, arts, and manufactures. Vols. 56 and 57. London 1887–1888. (*To complete circulating set.*)

From Sir William Crookes, O.M., F.R.S.

Weimarn, P. P. von. Zur Lehre von den Zuständen der Materie. Dresden 1914. 2 vols. pp. 190 and Atlas of 52 plates. M.7.—.

From the Publisher: Theodor Steinkopff.

II. *By Purchase.*

Allen, H. Stanley. Photo-electricity. The liberation of electrons by light. With chapters on fluorescence and phosphorescence, and photochemical actions and photography. London 1913. pp. ix + 221. ill. 7s. 6d. net. (*Recd.* 13/5/14.)

Barcroft, Joseph. The respiratory function of the blood. Cambridge 1914. pp. x + 320. ill. 18s. net. (*Recd.* 13/5/14.)

Dony-Hénault, O., Gall, Henri, and Guye, Philippe Auguste. Principes et applications de l'électrochimie. Paris 1914. pp. xiv + 686. ill. 30 fr. (*Recd.* 13/5/14.)

Mathet, L. Traité de chimie photographique. 3rd edition. Paris [1914]. 2 vols. pp. viii + 309, viii + 477. 20 fr. (*Recd.* 21/5/14.)

Simmersbach, Oskar. Grundlagen der Koks-Chemie. 2nd edition. Berlin 1914. pp. viii + 314. ill. M.10.—. (*Recd.* 13/5/14.)

Tammann, Gustav. Lehrbuch der Metallographie. Chemie und Physik der Metalle und ihrer Legierungen. Leipzig 1914. pp. xviii + 390. M.19.—. (*Recd.* 13/5/14.)

Wallach, Otto. Terpene und Campher. Zusammenfassung eigener Untersuchungen auf dem Gebiet der alicyclischen Kohlenstoffverbindungen. 2nd edition. Leipzig 1914. pp. xxvi + 580. M.24.—. (*Recd.* 13/5/14.)

III. Pamphlets.

Auerbach, *Friedrich*, and Pick, *Hans*. Das Verhalten von Bleicarbonat, basischem Bleicarbonat und Bleisulfat in wässerigen Lösungen kohlensaurer Alkalien. (From the *Arb. K. Gesund.*, 1913, 45.)

——— Das Verhalten von Bleichromat und basischem Bleichromat in wässerigen Lösungen kohlensaurer Alkalien.

(From the *Arb. K. Gesund.*, 1913, 45.)

——— Die Bleiabgabe schwerlöslicher Bleisalze an Natriumhydrocarbonat enthaltende Lösungen. (From the *Arb. K. Gesund.*, 1913, 45.)

Baker, *R. T.*, and Smith, *H. G.* A research on the eucalypts of Tasmania and their essential oils. Tasmania 1912. pp. 71. ill.

Batschinski, *A.* Untersuchungen über die innere Reibung der Flüssigkeiten. I. (From the *Ann. Sci. d'Encour. Sci. Exp., Suppl.* 3, 1913.)

Beam, *William*. The determination of humus in heavy clay soils. (From *The Cairo Sci. J.*, 1913, 7.)

The next Ordinary Scientific Meeting will be held on Thursday, June 4th, 1914, at 8.30 p.m., when the following papers will be communicated:

"Studies in the succinic acid series. Part I. The chlorides of succinic and methylsuccinic acids and their constitution." By G. F. Morrell.

"The dilution limits of inflammability of gaseous mixtures. Part I. The determination of dilution limits. Part II. The lower limits in air of hydrogen, methane, and carbon monoxide." By H. F. Coward and F. Brinsley.

"A comparative study of the absorption spectra of some compounds of phosphorus, arsenic, antimony, and bismuth." (Preliminary note.) By C. R. Crymble.

"The reactions of β -hydroxy- α -amino-compounds as cyclic structures." By J. C. Irvine and A. W. Fyfe.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 30

No. 431.

May 25th, 1914. Extra Meeting, Professor W. H. PERKIN, Sc.D., LL.D., F.R.S., President, in the Chair. This meeting was held in the Theatre of the Royal Institution, by kind permission of the Managers.

The PRESIDENT, in opening the proceedings, said: We are assembled in this historic place to pay a tribute of respect to the honoured and revered name of Faraday, and, at the same time, to add another to the list of illustrious men who have served as Faraday lecturers in the past. I do not need to introduce Professor Arrhenius to such a gathering as this. Many of you know him personally, and all of you are aware of the great influence which his brilliant and far-reaching generalisations have had on the development of modern science. I have therefore great pleasure on calling upon Professor Arrhenius to deliver the Faraday Lecture.

Professor ARRHENIUS then delivered the Faraday Lecture, of which the following account is an abstract.*

Most of my predecessors in this position, being mindful of the far-reaching importance of Faraday's discoveries, have treated general questions connected with Faraday's work, and bearing on our fundamental conceptions of matter. It is most opportune for me that the chief investigation made by myself falls within the great domain of electrochemistry, which Faraday

* Full Report, T., 1914, p. 1414.

enriched in a marvellous manner, especially by the discovery of his law, which is fundamental to all later work in this chapter of Science. The work on which I have to speak to you also concerns the constitution of matter. Solutions, especially those of salts, are of a peculiar character. Gay-Lussac, the most prominent physico-chemist of his time, paid special attention to solutions, and reached some conclusions which apparently are very modern. In his remarkable memoir of 1839, "*Considérations sur les forces chimiques*," he says: "As the effects of affinity do not change with temperature, whereas dissolution (solubility) is in a high degree dependent upon it, it is very difficult to avoid the assumption, that in dissolution as well as in evaporation, the product is essentially limited, at a given temperature, by the number of molecules which are able to exist in a certain volume of the solvent. They are separated from this, just as gaseous molecules are precipitated, by a lowering of temperature. . . . Dissolution is therefore in a high degree connected with evaporation, namely, in this respect, that both of them depend on the temperature and are subject to its variations. Hence they ought to show, if not a complete identity in their effects, at least a great analogy."

Here Gay-Lussac is a precursor of van't Hoff, who, forty-five years later, developed in such a masterly manner the idea of the analogy between matter in the dissolved and in the gaseous state.

In 1883 I investigated the electrical conductivity of different electrolytes, and came to the conclusion that the molecular conductivity increases with dilution, because the number of conducting molecules increases at the expense of the other, non-conducting, molecules. At infinite dilution all molecules of an electrolyte are conductors. This hypothesis led to the following chief conclusions. The molecular conductivity at infinite dilution is an additive property for all electrolytes, and not only within certain groups of electrolytes of similar composition, as maintained by Kohlrausch for the molecular conductivity of diluted electrolytes. According to the thermo-chemical data given by Berthelot and Thomsen, the stronger an acid is the greater is its molecular conductivity. The electrically conducting molecules are therefore the same as the chemically reacting molecules, the nature of which is characterised by Williamson and Clausius. At infinite dilution all acids must therefore be of the same strength. In accordance with these ideas, the velocity of reaction caused by an acid is proportional to its number of electrically conducting molecules per unit volume. This assertion could only be verified qualitatively in some very few cases, because experimental determinations were wanting. The heat evolved on neutralising one equivalent of an acid consisting of

only conducting molecules with a base of similar kind is always the same and equal to the heat produced when one equivalent of conducting molecules of water is transformed into one equivalent of non-conducting molecules. Therefore the heat of neutralisation of strong acids with strong bases at high dilution, as in the experiments of Thomsen, when they are composed almost entirely of conducting molecules, is very nearly the same for all acids and bases in equivalent quantities. When a salt such as potassium ferrocyanide, $K_4C_6N_6Fe$, the ions of which are $4K$ and C_6N_6Fe , enters into a chemical reaction with another salt in aqueous solution, there are formed only ferrocyanides and potassium salts, but not ferrous or ferric salts, because the result is always a rearrangement of the ions.

Such were the conclusions drawn from a rather small number of experimental data, and I do not wonder that my colleagues refused to take notice of these ideas, which seemed absolutely incompatible with the prevailing conceptions regarding the chemical nature of salts. Very soon after my memoir had appeared, Ostwald published measurements of the conductivity of thirty-four acids, and showed that the molecular conductivity of the acids is very nearly proportional to the velocity of reaction in catalytic processes (inversion of sucrose, hydrolysis of esters) caused by these acids. A little later he also proved that the relative strength of weak acids, as compared with that of strong acids, increases with dilution, so that all acids show a tendency to become of equal strength in infinite dilution. Both of these laws were predicted in my memoir of 1884. Then there were two different phenomena, the molecular conductivity and the chemical activity of acids, which quantitatively led to the same conclusion.

This was not, however, sufficient evidence to support the bold hypothesis that salts, including acids and bases, are to a great extent dissociated into their ions. Fortunately, I had not long to wait for further evidence. In 1886 van't Hoff published his revolutionising memoir on the analogy of dilute solutions to gases. There he showed that Raoult's measurements on the freezing point of aqueous solutions pointed to the fact that the influence of one molecule of a salt, such as potassium chloride, in great dilution, was double that of a simple molecule (alcohol, ammonia). This fact was wholly analogous to the fact that some substances, for example, ammonium chloride and phosphorus pentachloride, in gaseous state per molecule exert a pressure which is double as great as that produced by common undissociated gases. According to the law of Avogadro, the latter circumstance could only be explained by the hypothesis that the molecules of such substances as

ammonium chloride or phosphorus pentachloride are dissociated, when vaporised, into two molecules, namely, ammonia and hydrogen chloride or phosphorus trichloride and chlorine, respectively. The experimental proof of this hypothesis was also given by v. Pebal and v. Than in 1862 and 1864. From analogy to this experience, there seemed no other possibility open to explain the abnormal freezing point of solutions of potassium chloride than to suppose that the molecules of this salt were for the greater part dissociated into their ions K and Cl. Thus Raoult's measurements of the freezing point gave a means of determining the degree of dissociation of a great number of substances, the aqueous solutions of which he had investigated. By the aid of the measurements of Kohlrausch, regarding the molecular conductivity of different substances, it was possible to make another independent determination of their degree of dissociation. The two methods gave values which agreed very well with each other when dilute solutions (generally 1 per cent.) were examined. A thorough examination by A. A. Noyes and Falk (*J. Amer. Chem. Soc.*, 1912, **34**, 455) leads to the conclusion that for electrolytes consisting of two univalent ions the difference does not reach more than 2 per cent. if the solutions are 0.1 normal or less. The same is also valid for potassium sulphate and lead nitrate. For salts such as calcium chloride, calcium nitrate, magnesium chloride, etc., the deviation is much greater, the freezing-point method giving too high values. The deviation seems to have something to do with the hygroscopic nature of most of these salts. For copper sulphate and similar salts I have found that the said method gives too low values, which is due to the formation of double molecules, as Hittorf observed as early as 1859. The change of the molecular composition with dilution is seen from the simultaneous change of the rate of migration. The chief point, however, is that salts (strong acids or bases included) consisting of two univalent ions give the molecular depression $2 \times 1.85 = 3.7$, salts of one bivalent ion with two univalent ions give $3 \times 1.85 = 5.55$, salts of one trivalent ion with three univalent ions give $4 \times 1.85 = 7.4$, etc., whereas non-electrolytes give 1.85, all in extreme dilution. In extreme dilution the dissociation is complete.

Further, it was possible to calculate the degree of dissociation from the strength of the catalytic action of the acids, and in 1889 I showed that, within the limits of the errors of observation, the values found in this manner agree wholly with the values deduced from the magnitude of the electrical conductivity.

Of the three methods of determining the degree of electrolytic dissociation, that founded on the measurement of the electrical conductivity has always been preferred to the other two. This choice

is chiefly based on practical reasons, because the method is applicable to solutions in all solvents, and because it is possible to determine the conductivity with an accuracy of about 0.2 per cent. up to the highest dilutions investigated—about 0.0001 normal. The high dilutions are just those by which the trustworthiness of the theory ought to be controlled.

There was also a fourth fundamental fact in favour of the dissociation theory, namely, the additive properties of solutions of electrolytes. Certainly there are other additive properties valid also for non-dissociated substances; for example, the mass of a substance is an absolutely additive property, because it is equal to the sum of the masses of the constituents. If we except the mass, however, the additive character is far less prominent for undissociated molecules than for electrolytes.

The additive properties of solutions of electrolytes have for a long time attracted the attention of physico-chemists, because they are so strongly pronounced. If the electrolytes are dissociated into their ions, it is quite clear that the properties of their solutions may be regarded as the sum of the properties of the solvent and of the ions. The additive property which is most familiar to the chemist, is the chemical reaction of solutions of electrolytes. All salts containing chlorine as ion give the reaction "of chlorine," as it is said, but it would be more exact to say "of the chlorine ion." But chlorates containing the ion ClO_3 , perchlorates with the ion ClO_4 , the numerous chloro-salts of cobalt, platinum, iridium, etc., in which the chlorine is placed in the inner sphere, according to Werner, and all the salts of the chloro-substituted organic salts, do not give "the reaction of chlorine."

On these four strong foundations: the freezing point, the electrical conductivity, the chemical reactions and other additive properties of electrolytic solutions, as well as the strength of acids and bases, it was possible to erect a thoroughly solid building capable of sustaining attacks from without, and this building is the theory of electrolytic dissociation, first enunciated in 1887.

As a general conclusion, it may be stated that the difficulties inherent to the theory of electrolytic dissociation have been overcome only within a very recent period, when the observed facts have been more closely examined. It is now our task to investigate the causes which interfere with the simple laws in more concentrated solutions, and to find those other theoretical laws which govern these deviations.

In presenting the Faraday Medal to Professor Arrhenius at the conclusion of the lecture, the PRESIDENT said: Professor Arrhenius, it is now my very pleasant duty to hand you the

Faraday Medal, the highest honour the Society has to confer, and I should like to add an expression of our deep regard for you as an honoured member and our respect for you as a man of science.

Sir WILLIAM CROOKES, in proposing a vote of thanks to the lecturer, said: Mr. President, Ladies and Gentlemen,—With deep satisfaction I rise to propose a vote of thanks to our distinguished guest, and to offer our congratulations to him on his very interesting lecture. Professor Arrhenius has made his subject glow. He has drawn freely upon his vast stores of knowledge, and he invites us to share in the astonishing results of his researches. We are glad to welcome him in this country, where, indeed, he is already well known, and glad to felicitate him upon his command of our language, and on the fluency which is so marked a feature of his speech. We find it peculiarly fitting that the Faraday Lecture should be delivered by the Director of the Nobel Research Institute.

There is perhaps no need for me to remind you of Professor Arrhenius' scientific work. It is known to many how, more than a quarter of a century ago, he contributed to science one of its greatest generalisations, which he has now placed before you here, and which, after much strife, has taken its place as one of the corner-stones of chemistry. In early days I well remember the hostile objections. The hot controversies that raged reminded one of one of Ruskin's whimsical sayings—that most matters of any consequence are not merely to be regarded from two points of view, but are really three- or four-sided, or even polygonal, and "trotting round a polygon is stiff work for people who are in any way stiff in their opinions."

We can hardly listen to a Faraday Lecture without letting our thoughts dwell upon the great Faraday himself, and comparing him and his work with that of his eulogist, our illustrious guest. Faraday's work, like that of Arrhenius, lay chiefly in the border-land of chemistry. He was the pioneer in the region of physical chemistry, which of late years has revealed such boundless stores of wealth. There is an obvious close connexion between his electro-chemical laws and Arrhenius' theory of electrolytic dissociation. Faraday was a true epoch-maker, and a most striking example of the supreme value of those who cultivate science for its own sake without ulterior motives and without thought of the commercial value of their discoveries. How enormous is the value of Faraday's work the world has not yet by any means realised, but if in later times an adequate appreciation of its far-reaching results comes to be written, I am almost tempted to suggest that its title might be "Civilisation in the Making."

Arrhenius has suggested to us how worlds may be made, and surely Faraday did more than any one single individual to show us how to civilise worlds when made. A further resemblance may be observed between our guest and Faraday, and that is the remarkable gift of clear exposition. Not many of those present, I suppose, ever heard Faraday lecture; but some of you know of his fame in exposition, and I can assure you from personal experience that it has not in the slightest degree been exaggerated.

Professor Arrhenius' later work in immuno-chemistry, and his researches into the action of toxins and anti-toxins, have challenged the attention of the scientific world, and still more recently his investigations in cosmogony have startled staid scientific men. "Worlds in the Making" is a title bound to catch the mind's eye, and those of you who have read the book, and the later volumes on the Life of the universe, will no doubt agree with me as to the absorbing interest of the subject, the cogency of the arguments, and the skill with which they are handled. The world is deeply in need of researchers both of the type of those whose genius is characterised by that fertility of resource in experimental investigation exhibited by Faraday, and of the type of Arrhenius, whose gifts of intrepid speculation and imagination enable him to reveal new worlds of thought. Both are revolutionaries and founders of new kingdoms. Both types are rare. Both are "world compellers," and the world's debt to them is incalculable. I think we may begin to look hopefully forward to a time of fuller recognition of scientific genius and deeper appreciation of the value of scientific work, and certainly the British nation will not be found in the rear-guard in that desired advance. Once again let us offer our hearty thanks to Professor Arrhenius, and assure him of our genuine appreciation of his masterly exposition of, I might almost say, a sensational chemical problem.

Sir WILLIAM TILDEN, in seconding the vote of thanks, said: Ladies and Gentlemen,—I am one of those who cling tenaciously to the principle of submission to properly constituted authority. Consequently, when the President preferred a request that I should stand in this honourable position of seconding the vote of thanks to the Faraday Lecturer, which has been so eloquently proposed by the President of the Royal Society, I looked upon it as a command, and concealed my own misgivings, feeling as I did that I could not be regarded as a representative of any body of chemical opinion on the present occasion. We are here to-day to celebrate the great name of Faraday. A celebration of the same kind has been held by the Chemical Society on, I think, ten previous occasions, and it would be impossible, as you realise, no doubt, for

the Society effectively to carry out its wish except with the aid of our eminent colleagues and friends who have visited us from abroad on all these previous occasions.

We have had assistance from France, from Germany, from Italy, and from the United States. On the present occasion we have the great pleasure of welcoming among us, not for the first time—for his face and figure are familiar to everybody in London—we have the great pleasure of receiving here to-night and welcoming a representative of that great country which, I am almost tempted to say, has done more—but at any rate has contributed not less—than any other country to the advancement especially of chemical science.

It is only necessary to remember that Scandinavia has produced Scheele and Berzelius, beside many others whose names will doubtless occur to you. I think you will agree with me that our friend who has just delivered the Faraday Lecture is a worthy successor to his great countrymen whose names I have just mentioned.

I think the first qualification in a Faraday Lecturer must be that he has by his own work and his own researches contributed to the advancement of that department of science with which Faraday's name is, and has always been, associated; and in this case that quality is presented eminently by the Faraday Lecturer.

With regard to the theory of electrolytic dissociation, which has been the subject of the discourse this evening, my experience, perhaps, is very much that of a good many others, and probably the majority, in this room. When it first began to be discussed seriously, close upon twenty years ago, I confess I was among those who were strongly hostile. But I felt, as time went on, that I had to lay before my students—for I was a teacher in those days—at any rate an exposition of what other people believed in regard to this department of the theory of chemistry; and it was my experience that by merely presenting those views, so new and so unacceptable as they were to me at that time, I gradually got to feel that they were inevitable, and that they were absolutely necessary. One was forced to consider all the pros and cons, and ultimately I was led to a conviction of the very valuable character of the theory that I was then expounding. Of course, the theory of electrolytic dissociation, like every other theory which has become established in the fabric of theoretical chemistry, must pass through, has passed through, and will continue to pass through the same kind of experience as other theories. It has met, first of all, strong opposition and violent criticism, but it has ultimately been accepted, and all that remains is to clear away the few comparatively small difficulties.

At the same time, I always feel, and I hope most teachers feel, that every theory which we accept is bound to be modified more or less as time goes on. If not actually abolished, it will at any rate be modified very considerably in favour of something which is more comprehensive, and perhaps illuminated by a large number of new facts at present unknown to us.

I need scarcely say that I thank the President for allowing me the distinguished honour of standing here on this occasion, and I support most cordially the proposition which has been laid before the meeting by the President of the Royal Society.

The CHAIRMAN having put the vote to the meeting, it was carried with acclamation.

Professor ARRHENIUS, in acknowledging the vote of thanks, said: Amongst learned societies, the Chemical Society was one of the very first which lent me support and gave me encouragement. It has therefore been a great pleasure and favour to me to come back to London on repeated occasions and speak to and see my many dear friends in this Society. Every time I returned I felt that your kindness and friendliness towards me had increased. To-day it has reached its maximum, when you have conferred upon me the greatest honour you can give. I cannot express my deep feelings of gratitude towards the Society as I would wish, and I must confine myself to saying that you have my warmest and deepest thanks.

Thursday, June 4th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss sustained by the Society through the death of:

	<i>Elected.</i>	<i>Died.</i>
Sir Joseph Wilson Swan.....	June 3rd, 1865.	May 27th, 1914.

Mr. D. R. Keller was formally admitted a Fellow of the Chemical Society.

A certificate was read for the first time in favour of Mr. George von Kaufmann, jun., Christ's College, Cambridge.

Of the following papers, those marked * were read:

153. "The influence of nitro-groups on the reactivity of substituents in the benzene nucleus." By James Kenner.

The influence mentioned in the title was referred to two distinct functions exercised by nitro-groups. One of these, which is shared with other meta-directive groupings, consists in the conferment of a certain degree of mobility on substituents in ortho- or para-positions, and was explained in terms of Flürscheim's views. The other enables the substituent, thus rendered mobile, to take part in reactions, in spite of the steric influences to which it is exposed. This function is exercised most powerfully by the nitro-group, and was correlated with another property characteristic of nitro-groups, namely, the power to form additive compounds.

An alternative theory, proposed by Borsche (*Annalen*, 1911, **386**, 356; 1913, **402**, 81), was also discussed.

With the assistance of Mr. R. Curtis, and in connexion with the views developed above, the action of hydrazine hydrate on methyl 2-chloro-3:5-dinitrobenzoate was studied and shown to lead at once to the formation of 5:7-dinitro-3-keto-1:3-dihydroindazole, without admitting of the isolation of the intermediate hydrazine derivative. In the case of phenylhydrazine, the main product was 5:7-dinitro-3-keto-2-phenyl-1:3-dihydroindazole, accompanied by a small proportion of 2:4-dinitro-6-carbomethoxyhydrazobenzene, and another compound of unknown constitution.

The indazole derivatives named gave rise to quinonoid sodium salts, whilst, by the action of phosphoryl chloride at 180°, 3:5:7-trichloroindazole and 3:5:7-trichloro-2-phenylindazole were produced, the nitro-groups attached to the benzene nucleus having suffered displacement by chlorine atoms.

DISCUSSION.

Dr. FLÜRSCHHEIM welcomed Dr. Kenner's paper as an interesting contribution on the problem of benzene substitution. It appeared that, generally, chemical reactivity was governed by the nature of the affinity of the atoms involved (polar factor), by the amount of that affinity (quantitative factor), and by considerations of space (steric factor). Dr. Kenner had taken the last two factors into consideration, and he had been able to embrace a considerable number of facts. At the same time, the polar factor could, of course, not always be neglected. For the mobility, for instance, of a nitro-group in 1:3:5-trinitrobenzene (Lobry de Bruyn), of fluorine in *m*-fluoronitrobenzene (Holleman), or of the 1-bromine in 1:2:4:6-tetrabromobenzene (Jackson and Calvert),

* This paper was read at the meeting on May 21st, 1914.

it even appeared that the polar factor was alone responsible; in other words, even when a sufficient *amount* of affinity was available for it, a substituent might easily be detached from the nucleus when both exhibited strong electropolarity of the same kind, so that the *nature* of their affinity was not conducive to mutual saturation (compare *Ber.*, 1906, **39**, 2016). Undoubtedly, the problem of the replacement of one benzene substituent by another was more complex than that of the mere substitution of hydrogen, and he was glad that Dr. Kenner had brought the subject before the meeting.

Professor J. T. HEWITT referred to the work of Borsche and Bahr (*Annalen*, 1913, **402**, 81), which shows that in the apparently symmetrical 4:6-dichloro-1:3-dinitrobenzene, one halogen atom is more mobile than the other. This might be explained if the products with amines, etc., assumed a quinonoid configuration; for if the 6-chlorine atom had reacted, and quinonoid structure were established between positions 6 and 1, the linking between the carbon atoms 3 and 4 must of necessity be a single one.

Dr. KENNER agreed that his views might need amplification in order to become applicable to all the observed cases of mobility, and cited, as an example, the formation of the trichloroindazoles mentioned above. In his opinion, recent work on the metallic ketyls lent strong support to the view that colour was connected with the presence of residual affinity, and therefore to Hantzsch's formula for the nitroanilines. He drew attention to another apparent fallacy in the views expressed by Borsche and Bahr, and suggested an alternative explanation of the results obtained by these workers.

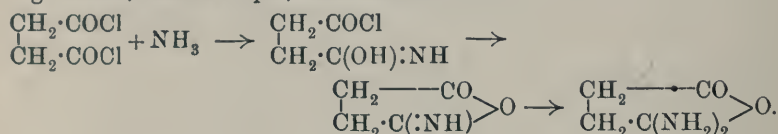
***154. "Studies in the succinic acid series. Part I. The chlorides of succinic and methylsuccinic acids, and their constitution."**
By George Francis Morrell.

Since succinyl chloride gave with ammonia a 90 per cent. yield of *as*-succinamide, and with benzene and aluminium chloride a similar amount of succinophenone, Auger (*Ann. Chim. Phys.*, 1891, [vi], **22**, 326) concluded that it was a mixture of two isomerides. Meyer and Marx (*Ber.*, 1908, **41**, 2459) found that it gave with alcohols only the normal esters, and suggested a theory of tautomerism. In the present investigation, succinyl and methylsuccinyl chlorides have been prepared, and a consideration of their physical properties and anomalous behaviour with ammonia and substituted ammonias is held to disprove Auger's theory, and to lend no support to the tautomerism theory. Succinyl chloride, for

example, was found to be a crystalline solid, melting sharply at +20°, and boiling at 87—88°/18 mm. Whether the first or last portions of the distillate were taken, it gave with aniline nothing but the *s*-anilide (m. p. 230°); with methylamine, only a 15 per cent. yield of the *s*-dimethylamide; and with ammonia, almost entirely the *as*-amide.

It is concluded that these acid chlorides are definite chemical individuals, and that there is no satisfactory evidence whatever for assigning to them any other constitution than that of normal acid chlorides, $\text{COCl}\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{COCl}$.

The formation of asymmetric products probably takes the following course, for example, with ammonia:



***155. "The dilution limits of inflammability of gaseous mixtures.**

Part I. The determination of dilution limits. Part II. The lower limits for hydrogen, methane and carbon monoxide in air."

By Hubert Frank Coward and Frank Brinsley.

The smallest amount of hydrogen in an inflammable mixture of hydrogen and air has been variously stated as low as 4.5 and as high as 10 per cent. Similarly, the values given for the greatest amount of hydrogen in an inflammable mixture of hydrogen and air are as low as 55 per cent. and as high as 80 per cent. The hydrogen-oxygen mixtures show similar want of accord in the results of previous workers. A partial explanation exists in Clowes' observation that in certain weak mixtures a flame may be propagated upwards, but not downwards.

A re-examination of the inflammability of weak gaseous mixtures has been started, based on the definition that a mixture at a defined temperature and pressure is inflammable *per se* if, and only if, it will propagate flame indefinitely, the temperature and pressure of the unburnt gases being constant. The flame observed in many weak mixtures travels more slowly than the convection current set up by the flame, so that the criterion of inflammability is the observed travel of a flame upwards through a vertical vessel of sufficiently great dimensions to avoid appreciable cooling influence by the walls and to provide a sufficient length for observation of the flame to leave no doubt as to its capacity for indefinite self-propagation.

The experiments of previous observers do not satisfy this criterion, and the critical experiments of the authors have been carried out in vessels, one having a capacity of 170 litres, another a length of 4·5 metres. With all three gases used, the flames in certain weak mixtures have been observed to start as vortex rings, which rose, expanded, and ultimately broke into a general self-propagating inflammation, or were extinguished. The lower limits of inflammability of mixtures of each of the three gases with air saturated with aqueous vapour at 17° to 18° were:

Hydrogen	4·1 per cent.
Methane	5·3 ,,
Carbon monoxide.....	12·5 ,,

DISCUSSION.

Professor BONE drew attention to the great importance of accurate information concerning the behaviour of gaseous mixtures at or near the lower explosion limits, and congratulated the authors on both their experimental demonstration and the beautiful photographs which they had exhibited. He agreed in principle with the authors' definition of "inflammability," but pointed out the necessity of distinguishing between "ignitability" and "inflammability." The phenomenon of ignition was very complicated, and was probably not a purely thermal one, as Professor W. M. Thornton had recently shown in an important communication to the Royal Society on the electrical ignition of gaseous mixtures, from which it appeared probable that ionisation was a factor precedent to the actual combustion.

Dr. SCOTT suggested that the mixtures of hydrogen with oxygen and with air might be made more luminous by using weighed quantities of sodium, which would give the required quantities of hydrogen in contact with the water. The brilliant yellow of the flame would probably enable much more detail to be visible to the eye and to be recorded on the photographic plate.

Dr. E. RIDEAL asked whether there was any indication of a dark wave preceding the luminous cap which travelled up the tube.

The dark wave caused by local compression of the gas could be conveniently photographed by a method which he had used with great success in the case of rifle bullets travelling through different gases. The bullet in its course is made to traverse two copper gauze disks placed close to one another; by this means contact is made between the two disks, which are connected to the out-sides of the Leyden jars of a Wimshurst machine. The primary spark follows a short time after contact is made, and if there is a photographic plate opposite to the spark-gap of the Wimshurst,

the bullet, passing between the spark and the plate, throws its shadow on the latter. In front of the photograph of the bullet is always observable a parabolic-like curve, being a cross-section of the paraboloid-shaped mass of compressed air partly dragged and partly pushed forward by the bullet in its flight. The line on the plate is caused by the fact that the compressed air has a different refractive index to that surrounding it. Different gases gave curves of the same order, but different constants. In the present case, during combustion one might expect local differences of pressure, indications of which could be obtained by an adaptation of the foregoing method.

Dr. COWARD agreed with Professor Bone that it was desirable to distinguish between inflammability and ignitability. A large flame might be developed in a mixture when an electric spark was passed or a jet of flame introduced into it, although the inflammation would not be capable of indefinite self-propagation. This mixture would therefore not be inflammable *per se*, but a possibly dangerous flame might be formed in it; the initial impetus of the spark was not rapidly dissipated. The authors had seen such flames in mixtures just below the dilution limit which were nearly 30 cm. wide, and travelled 60, 90, or even 120 cm. from their source.

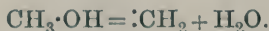
Dr. Scott's suggestion for rendering the hydrogen flames more luminous would be useful for photographic purposes; up to the present, the authors had desired to see and record the appearance of flame in pure mixtures, and for that reason to avoid the presence of spray or dust particles.

***156. "The thermal decomposition of methyl alcohol."**

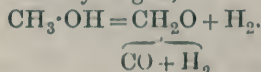
By William Arthur Bone and Hamilton Davies.

The authors find that methyl alcohol vapour decomposes on heating principally in two ways, namely:

(1) An essentially low-temperature decomposition into, primarily, steam and a residue, :CH_2 , which has a fugitive free existence,



(2) The normal high-temperature decomposition primarily into formaldehyde and hydrogen, the formaldehyde then decomposing into carbon monoxide and hydrogen,



Thus, at 650° , 20 to 25 per cent. of the methyl alcohol decomposes according to (1), the remainder according to (2), the H_2C :

formed during (1) combining with part of the H_2 produced during (2), forming methane.

At 1000° , more than 95 per cent. of the methyl alcohol decomposes according to (2), the remainder according to (1).

At neither temperature is there any separation of carbon, nor could any acetylene be detected in the products.

157. "A comparative study of the absorption spectra of some compounds of phosphorus, arsenic, antimony, and bismuth." (Preliminary note.) By Cecil Reginald Crymble.

In accordance with the rule connecting valency and absorption (T., 1912, 101, 266), it has been found that solutions of compounds of the above elements absorb ultra-violet light, the extent of the absorption varying greatly with the nature of the compound.

If the chlorides ECl_3 are compared, the limit of general absorption is displaced towards the visible on passing from phosphorus trichloride to bismuth trichloride, and in the latter compound an absorption band makes its appearance in Bi/1000 solution with a head at 2850.

The pentachlorides of phosphorus and antimony have been examined, and they possess much greater absorptive power than the corresponding trichlorides. The limit of the general absorption of antimony trichloride and the absorption band of bismuth chloride are displaced towards the visible on formation of the complex salts $ECl_3 \cdot nMCl$.

Like sulphates and selenates, the highly oxidised phosphates and arsenates are quite diactinic; antimonates and arsenites show slight absorption; and, as is known, bismuthic acid is a red powder.

The grouping $P:O$ in the phosphorus oxy-acids is devoid of absorptive power, and phosphoryl chloride is almost diactinic.

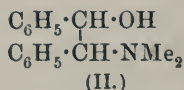
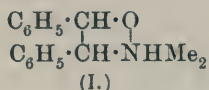
The investigations are being extended to the fourth group of elements, especially to tin and lead; and from the variations in the absorptive power of solutions of stannic chloride, which occur on keeping, it is hoped to gain some information on the constitution of these salts.

158. "The reactions of α -amino- β -hydroxy-compounds as cyclic structures." By James Colquhoun Irvine and Alexander Walker Fyfe.

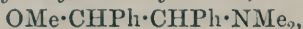
The behaviour of β -hydroxy- $\alpha\beta$ -diphenylethylamine towards methylating agents has been studied in order to ascertain if compounds in which a secondary hydroxyl group and a primary amino-

group are attached to neighbouring carbon atoms are capable of reacting in accordance with a cyclic formula. By the action of silver oxide and methyl iodide on the amine, a dimethyl derivative melting at 135—137° was obtained. As this compound contained no normal methoxyl group, yet nevertheless failed to form a methiodide, a hydrochloride, or a platinichloride, it is regarded as the *anhydride of β -hydroxy- $\alpha\beta$ -diphenylethyldimethylammonium hydroxide* (I). In the absence of salt-forming properties, and in its capacity to combine with silver iodide, the compound resembles the alkyl glucosamines, for which a cyclic structure has already been suggested.

On the other hand, direct methylation of β -hydroxy- $\alpha\beta$ -diphenylethylamine by means of methyl iodide gave successively *β -hydroxy- $\alpha\beta$ -diphenylethylmethylamine*, *β -hydroxy- $\alpha\beta$ -diphenylethyldimethylamine* (II), and the corresponding *methiodide*. The properties of these substituted amines are perfectly regular in that they form salts and platinichlorides, from which it may be concluded that the normal open-chain structure may be applied to them. The following formulæ are consequently ascribed to the isomeric compounds isolated:



The constitution assigned to β -hydroxy- $\alpha\beta$ -diphenylethyldimethylamine (II) was confirmed by the conversion of the compound into *β -methoxy- $\alpha\beta$ -diphenylethyldimethylamine*,



which, in turn, reacted with nitrous acid to give hydrobenzoin methyl ether. The same methoxy-amine resulted from the methylation of *β -methoxy- $\alpha\beta$ -diphenylethylamine*, both by the silver oxide reaction and by the agency of methyl iodide, the compound in the former case being isolated as the *methiodide* combined with one molecule of silver iodide.

The results of the investigation are applied to the constitution of the alkyl glucosamines, and the capacity of these compounds to combine simultaneously with alkyl haloids and with silver haloids is explained on the assumption that the addition takes place through the oxygen atom of the ring.

159. "Ionic equilibria across semi-permeable membranes."

By Frederick George Donnan and Arthur John Allmand.

Experiments have been made on the distribution of potassium chloride between two compartments separated by a copper ferro-

cyanide membrane, one compartment containing potassium ferrocyanide. The higher concentration of potassium chloride in the solution free from ferrocyanide, and the quantitative relation of this unequal distribution to the concentration of chloride and ferrocyanide, have been established.

The results agree, in general, with the view of such membrane-equilibria proposed by Donnan. A discussion of the distribution data and the measurements of electromotive force appears to show that, at all events in the case of a copper ferrocyanide membrane and potassium ferrocyanide solutions, the phenomena are quantitatively not so simple as supposed in the theory mentioned.

160. "The effect of ring-formation on viscosity."

By Ferdinand Bernard Thole.

The opinion previously put forward that ring-formation is accompanied by an increase in viscosity has been confirmed by a comparison of the viscosities of a considerable number of cyclic compounds (carbocyclic and heterocyclic rings containing from two to seven atoms) with those of corresponding open-chain analogues. The chemical types of the latter have been carefully chosen to correspond with those of the cyclic compounds, since the results of some previous investigators with other physical properties have been confused by illegitimate comparisons.

Viscosity has been found to fall in line with certain other physical properties in showing an anomaly which varies steadily as the complexity of the ring increases, and giving no change of direction on passing the five-membered ring-system.

161. "Action of monochloroacetic acid on thiocarbamide and monoalkylated thiocarbamides." By Prafulla Chandra Rây and Francis V. Fernandes.

By the action of monochloroacetic acid on thiocarbamide in aqueous solution, the latter evidently tautomerises, and gives rise to *formamidinethiolacetic acid*, $\text{NH}_2\cdot\text{C}(\text{:NH})\cdot\text{S}\cdot\text{CH}_2\cdot\text{CO}_2\text{H}$. If, however, acetone is used as a solvent, the corresponding hydrochloride of the base is obtained. Similar hydrochlorides are yielded by the action of monochloroacetic acid on mono-substituted thiocarbamides in acetone solution; thus, the hydrochlorides of *methylformamidine-* and *allylformamidine-thiolacetic acids* have been prepared.

162. "Action of Grignard reagents on acid amides."

By Alex. McKenzie, Geoffrey Martin, and Harold Gordon Rule.

In continuation of former work (McKenzie and Wren, T., 1908, 93, 310; 97, 473; Wren, T., 1909, 95, 1583, 1593), the authors have examined the action of Grignard reagents on several acid amides. In those cases where a ketol was isolated as one of the products, the yield was small. A mixture of benzoin and $\alpha\beta$ -dihydroxy- $\alpha\beta\beta$ -triphenylethane is produced by the action of magnesium phenyl bromide on mandelopiperidide. The formation of benzoylbenzylcarbinol from α -hydroxy- β -phenylpropionamide is accompanied by the formation of $\alpha\beta$ -dihydroxy- $\alpha\alpha\gamma$ -triphenylpropane.

d-Benzoylbenzylcarbinol undergoes racemisation at the ordinary temperature when a few drops of sodium ethoxide are added to its alcoholic solution. This change is, however, much slower than that undergone by *l*-benzoin under similar conditions; the value for the rotation of a 5 per cent. solution falls to about one-half of the original after 481 hours have elapsed.

163. "Synthetic hydrocarbons allied to the terpenes."

By Walter Norman Haworth and Alexander Walker Fyfe.

The method used by Blaise (*Compt. rend.*, 1901, 133, 1217) for the production of ketones from nitriles has been applied in the synthesis of three hydroaromatic ketones of the *cyclohexene* series. These were converted into optically active and inactive carbinols and hydrocarbons analogous to the members of the terpene group. The alteration in the rotation values due to the synthetic changes has been carefully studied, as have also the spectrochemical properties. The compounds described are interesting examples of "multiple disturbance" of conjugation, and show the expected diminution of exaltation in accordance with the views of Auwers and Eisenlohr.

164. "Asymmetric tervalent nitrogen." (Preliminary note.)

By Tom Sidney Moore.

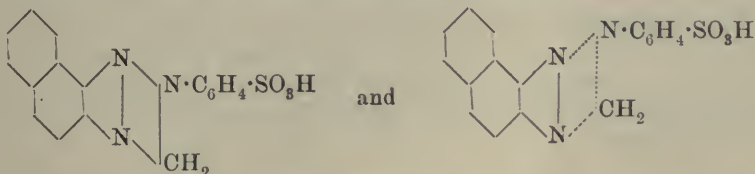
The cause of the failure of the attempts that have been made to obtain optically active compounds owing their asymmetry to the presence of tervalent nitrogen atoms attached to three different groups is probably the rapid racemisation of the substances investi-

gated, which have all been of the type $N \begin{matrix} \swarrow a \\ \searrow b \\ \nearrow c \end{matrix}$.

Compounds of the type $N \begin{array}{c} \diagup a \\ \diagdown b \\ \diagup c \end{array} N$ and $N \begin{array}{c} \diagup a \\ \diagdown b \\ \diagdown b \end{array} N$, in which a , b ,

and c are three different divalent groups or chains, of which at least one is unsymmetrical with regard to the two nitrogen atoms, should exist in two enantiomorphic forms. Racemisation might be expected to be slow, or even non-existent, in compounds of the first type, and it might be slow enough in compounds of the second type to allow of the demonstration of isomerism. Experiments on the preparation of suitable compounds of the first type are now in progress; of the second type several examples are known, and one of these has been examined.

The compound chosen was 2-*p*-sulphophenyl-2:3-dihydro-1:2:4-naphthaisotriazine, which was prepared according to the general method given by Meldola and Forster (T., 1891, **59**, 678), and found to be very similar in properties to the phenyl derivative described by them. The two possible forms would be:



The following results were obtained with a specimen of the brucine salt of this compound after it had been twice recrystallised from alcohol.

(1) The brucine salt was treated at 0° with excess of *N*-sodium hydroxide, and the resulting aqueous solution extracted with chloroform until it was free from brucine (three extractions). In four such experiments the resulting alkaline solution of the sodium salt showed a small but definite dextrorotation, which decayed with time, until after a few hours the solution was optically inactive. The values for the initial specific rotation of the sodium salt were between $+ [3.5^{\circ}]$ and $+ [1.7^{\circ}]$. Parallel experiments with the acid itself gave, as one expected, inactive solutions. In other experiments with the brucine salt, where only the equivalent quantity of sodium hydroxide was used, the solution of the sodium salt was inactive; this agrees with the experience of Mills and Bain (T., 1910, **97**, 1866; 1914, **105**, 64), who found that excess of alkali hindered the racemisation of their compounds.

(2) The brucine salt, when added to chloroform, first dissolves completely, and then deposits some of the acid, this process not being complete for some hours. One such solution was allowed to remain overnight, and its rotatory power was measured after

filtration. It was then kept for three days in a closed vessel (during which period no further acid was deposited), and its rotatory power again measured. The angles observed were -0.15° and -0.22° respectively. This change of rotatory power with time indicates that the brucine salt contained an excess of the dextro-acid, which racemised gradually on keeping.

Mr. J. J. Manley very kindly estimated the sulphur in a specimen of the acid recovered from the brucine salt.

Found, S=9.65.

$C_{17}H_{13}O_3N_3S$ requires S=9.44 per cent.

The author is proceeding with a detailed examination of this and similar compounds; in the meantime, the results given above offer definite evidence of asymmetry in tervalent nitrogen atoms attached to three separate groups.

165. "The alkaloids of *Daphnandra micrantha*."

By Frank Lee Pyman.

The alkaloids of the bark of the Queensland plant, *Daphnandra micrantha*, Benth., have been investigated, and three new crystalline bases, *daphnandrine*, $C_{36}H_{38}O_6N_2$, *daphnoline*, $C_{34}H_{34}O_6N_2$ (or $C_{35}H_{36}O_6N_2$), and *micranthine*, $C_{36}H_{32}O_6N_2$, have been isolated and characterised.

166. "The relation between the absorption spectra and the constitution of certain *isoquinoline* alkaloids and of the alkaloids of *ipecacuanha*." By James Johnston Dobbie and John Jacob Fox.

It was shown that certain *isoquinoline* alkaloids, including tetrahydroberberine, laudanoline, corydaline, the salts of cryptopine and protopine, which possess similar spectra, are all characterised by the presence of unreduced nuclei derived from catechol. When the spectra of one molecule of these alkaloids are compared with the spectra of two molecules of creosol (4-hydroxy-3-methoxytoluene), they are seen to have their band in the same position. In these, as in cases previously described (T., 1911, **99**, 1254; 1912, **101**, 77; 1913, **103**, 1193), the reduced part of the molecule has very little influence on the spectrum.

It was also shown that the band of the spectrum of morphine, which contains one catechol nucleus, only differs from that of creosol in being somewhat narrower.

Emetine and cephaeline give the same spectrum as the above-mentioned alkaloids, and therefore in all probability also contain catechol nuclei, a conclusion which is in harmony with the facts of their constitution, so far as these are known (Carr and Pyman, P., 1913, **29**, 226; 1914, **30**, 157).

167. "The interaction of benzoin and the chlorides of dibasic acids."

By Hamilton McCombie and John Wilfrid Parkes.

The interaction of benzoin and dibasic acid chlorides was studied in the hope of obtaining compounds derived from one molecule of benzoin and one molecule of the acid chloride, which would prove to be derivatives of stilbenediol. The following acid chlorides were employed: carbonyl chloride, oxalyl chloride, phthalyl chloride, and camphoryl chloride. In all cases, however, even when excess of benzoin was employed, the only compounds that could be isolated were formed from two molecular proportions of benzoin and one of the acid chloride. In the case of oxalyl chloride, two different compounds were isolated, both possessing the formula $C_{30}H_{22}O_6$.

168. "The fractional distillation of petroleum."

By James McConnell Sanders.

In the examination of crude petroleum, burning oil, or petrol by the distillation test, it is often desirable to determine the specific gravity of successive fractions; the rule of the New York Produce Exchange requires, for an oil to be considered as a "pure natural oil," that it should exhibit a regular gradation in the densities of successive fractions.

When the Engler method is used for fractionating an oil, or when the amount of sample available is small, the ordinary rapid methods of determining the specific gravities of the fractions cannot be conveniently used. The author described an apparatus whereby the gravity of successive fractions may be determined rapidly during the distillation, the fractions being removed in succession or mixed, and the gradual change of density determined as the distillation proceeds. From the data obtained, curves may be plotted showing the behaviour of an oil during close fractionation, or the effect of cracking at any stage.

Some special difficulties found in the distillation of heavy asphaltic oils of Mexican origin were discussed, more especially in regard to the determination of water, and the carrying of the distillation to the "coking stage."

A special distillation flask was described, whereby these difficulties are overcome by means of an electrically deposited copper coating to the flask, an electrically heated and controlled still-head, and the subsequent removal of adhering water in the side-neck and condenser tubes by means of absolute alcohol, which is then treated with magnesium amalgam and the evolved hydrogen measured.

169. "Mercuration of aromatic amines." (Preliminary note.)

By Gilbert T. Morgan and J. Campbell Elliott.

The circumstance that aromatic compounds containing metallic and metalloidal substituents are becoming increasingly important in therapeutics renders the conditions of formation of these products a matter of considerable interest. The introduction into aromatic nuclei of arsenic, antimony, and similar metalloids involves reactions needing special precautions, and proceeding only slowly to completion. On the contrary, the mercuration of aromatic amines proceeds so rapidly and quantitatively that the process can be readily demonstrated as a lecture experiment. One gram of aniline is added to 6.6 grams of mercuric acetate dissolved in 300 c.c. of cold methyl alcohol, and the solution boiled for two minutes. Another 6.6 grams of mercuric acetate dissolved in 300 c.c. of methyl alcohol are boiled for the same time, and serve for a control experiment. The two hot solutions are each poured into 300 c.c. of water containing 7.5 grams of potassium iodide. The control solution of mercuric acetate gives immediately yellow mercuric iodide, changing almost instantaneously into the stable red modification. The solution to which the aniline has been added no longer contains mercuric ions, the whole of the mercury having become attached to the aromatic nucleus. It yields a yellowish-white precipitate of di- and tri-iodomercurianilines, which is quite distinct from the red precipitate obtained in the control experiment. *m*-Toluidine (1.1 gram) may be substituted for aniline in the foregoing experiment, with a similar result, the yellowish-white precipitate containing a mixture of di- and tri-iodomercuri-*m*-toluidines (compare Schrauth and Schoeller, *Ber.*, 1912, 45, 2808).

Other bases containing unsubstituted ortho- and para-positions behave in a similar manner. With methylaniline and dimethylaniline, similar proportions (2—3 molecules) of mercuric acetate are taken up, but the resulting yellowish-white, organic mercuriodides are discoloured by red and green oxidation products respectively. An analogous reaction occurs with diethylaniline, the amount of coloured by-product being less. Diphenylamine reacts with 5—6 molecular proportions of mercuric acetate, and yields a voluminous, white organo-mercuri-iodide. Aromatic bases, partly substituted in their reactive ortho- and para-positions, are also readily mercured, but the amount of mercuric acetate taken up diminishes as substitution increases. *o*-Toluidine and dimethyl-*o*-toluidine condense with two molecular proportions of mercuric acetate, and give white organo-mercuric iodides, but with the latter base the reaction proceeds very slowly. *p*-Toluidine reacts

readily with one molecular proportion of mercuric acetate. Further treatment with more acetate leads to oxidation. Methyl-*p*-toluidine and dimethyl-*p*-toluidine behave similarly.

α -Naphthylamine and β -naphthylamine condense, respectively, with one and two molecular proportions of mercuric acetate, and yield the corresponding organo-mercuric iodides (compare Brieger and Schulemann, *J. pr. Chem.*, 1914, [ii], 89, 97).

When the foregoing organo-mercuric iodides are left in contact with hydriodic acid, some of the organically combined mercury is removed in the form of mercuric iodide, but these compounds are not affected by neutral iodides.

170. "The viscosities of mixtures of formamide with the alcohols."
By Solomon English and William Ernest Stephen Turner.

In confirmation and extension of previous work (Merry and Turner, T., 1914, 105, 748), the viscosities of mixtures of formamide with *n*-propyl, *isobutyl*, and *isoamyl* alcohols at 25° have been measured. It had previously been shown that with water, methyl alcohol and ethyl alcohol, the negative deviation of the observed from the calculated viscosity grew less in the order of the substances named, and it was now shown that the deviation becomes positive with *n*-propyl alcohol, although the viscosity curve does not attain a maximum, and that the *isobutyl* and *isoamyl* alcohol curves each contains a maximum point. The *n*-propyl alcohol curve is sinuous, and the sinuosity is developed in the two higher alcohols, so that they contain, not only a pronounced maximum, but also a minimum, point.

171. "Action of nitro-substituted aryl haloids on alkali thiosulphates and selenosulphates." By Douglas Frank Twiss.

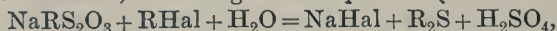
Various investigations have already shown that the alkyl haloids can react with the alkali thiosulphates, giving the corresponding alkali alkyl thiosulphates; but the few corresponding aryl thiosulphates discovered hitherto have been prepared by less simple processes, usually depending on oxidation of a mixture of sodium thiosulphate and an aromatic substance.

Unsubstituted aryl haloids fail to react with sodium thiosulphate, but the 2:4-dinitro- and 2:4:6-trinitro-phenyl haloids readily enter into action with not more than a semimolecular proportion of sodium thiosulphate, yielding, not the corresponding organic thiosulphate compounds, which appear to be capable of only transient existence, but the corresponding sulphides. In a similar manner, reaction with not more than a semimolecular pro-

portion of potassium selenosulphate produces the corresponding selenides.

When an excess of sodium thiosulphate is used with 4-chloro- or 4-bromo-1:3-dinitrobenzene, the resulting 2:4-dinitrophenyl sulphide is not the only product, for the solution subsequently deposits 2:4-dinitrophenyl disulphide. An excess of potassium selenosulphate yields almost exclusively 2:4-dinitrophenyl diselenide.

These results are explained by the primary formation of an unstable alkali aryl thiosulphate or selenosulphate which, in the presence of excess of aryl haloid, passes into the corresponding sulphide or selenide, according to the equation (for the former case)



whilst with an excess of inorganic thiosulphate or selenosulphate the alkali aryl thiosulphate or selenosulphate produced subsequently decomposes, as their aliphatic analogues readily do, yielding disulphide or diselenide.

At the next Ordinary Scientific Meeting, on **Thursday, June 18th, 1914, at 8.30 p.m.**, there will be a ballot for the election of Fellows, and the following papers will be communicated:

"Nitrogenous constituents of hops." By A. Chaston Chapman.

"The isomerism of the oximes. Part IV. The constitution of the *N*-methyl ethers of the aldioximes and the absorption spectra of oximes, their sodium salts and methyl ethers." By O. L. Brady.

"The wet oxidation of metals. Part III. The corrosion of lead." By B. Lambert and H. E. Cullis.

"Studies in the camphane series. Part XXXV. Isomeric hydrazoximes of camphorquinone and some derivatives of amino-camphor." By M. O. Forster and E. Kunz.

"The velocities of combination of sodium phenoxides with olefine oxides." By D. R. Boyd and E. R. Marle.

"Colouring matters contained as glucosides in the flowers of some Indian plants." By A. G. Perkin and I. Shurlman.

"A new chlorocamphor." (Preliminary note.) By T. M. Lowry and V. Steele.

"Ideal refractivities of gases." By W. J. Jones and J. R. Partington.

"The purification and physical properties of α -bromonaphthalene." By M. Jones and A. Lapworth.

"Determination of water in alcohol-water mixtures by the clouding points of mixtures with α -bromonaphthalene." By M. Jones and A. Lapworth.

CERTIFICATES OF CANDIDATES FOR ELECTION AT THE NEXT BALLOT.

N.B.—The names of those who sign from “General Knowledge” are printed in *italics*.

The following Candidates have been proposed for election. A ballot will be held on Thursday, June 18th, 1914.

Aufilogoff, Nicholas Alexander,
Thames Haven, Essex.

Chief Chemist and Works Manager to London & Thames Haven Oil Wharves, Ltd., 101 Leadenhall St., E.C. Seven years Chemist-in-charge, Refinery European Petroleum Co. Four years Refinery Manager London & Thames Haven Oil Wharves, Ltd. Eleven years Chief Chemist to same Co.

Boverton Redwood.

Vivian B. Lewes.

Robert Redwood.

J. S. S. Brame.

Bertrand Turner.

Berry, Harry,

The Northern College of Pharmacy, Burlington St., Manchester.

Pharmaceutical Chemist. Lecturer in Chemistry and Physics at the Northern College. Formerly engaged in the assay laboratories of the University College Hospital, London. Student under Prof. Hewlett at Bacteriological Lab., King's College, Strand, W.

E. Gower Bryant.

C. H. Hampshire.

Henry Garnett.

G. T. W. Newsholme.

M. S. Pickering.

G. Crewe Chambres.

Boon, Alfred Archibald,

Chemistry Department, Heriot Watt College, Edinburgh.

Assistant Professor of Chemistry, Heriot Watt College, Edinburgh. D.Sc. (Edinburgh). Author of papers communicated to the Society. Examiner in Chemistry to the Pharmaceutical Society (North British Branch).

D. S. Jerdan.

Isidor Morris Heilbron.

Forsyth J. Wilson.

A. Davidson.

A. Scott Dodd.

Collins, Stanley Winter,

1, Tideswell Road, Putney, S.W.

Lecturer in Chemistry at King's College, University of London.
B.Sc. Hons. Chemistry, London; Fellow of the Institute of Chemistry.

John M. Thomson.

W. D. Halliburton.

Herbert Jackson.

Patrick H. Kirkaldy.

Henry L. Smith.

Cremer, Herbert William,

Preston Lea, Faversham, Kent.

Student Demonstrator in Chemistry, University of London, King's
College. B.Sc. London (1st Class Hon.) in Chemistry.

John M. Thomson.

W. D. Halliburton.

Herbert Jackson.

W. B. Bottomley.

Patrick H. Kirkaldy.

P. A. Ellis Richards.

Cutler, John Vernell,

Rose Cottage, Farringdon Lane, Ribbleton, Preston.

Associate Municipal School of Technology (Chemistry, 1908),
Manchester. Previously Assistant Chemist, The Badische Co., Ltd.,
Manchester. Now Chemist to Messrs. Horrockses, Crewdson & Co.
Ltd. (Preston).

Reginald B. Brown.

Stanley J. Peachey.

Jul. Hübner.

Edmund Knecht.

F. S. Sinnatt.

E. L. Rhead.

Galstaun, Shanazar Galstaun,

Abbotsholme, Derbyshire.

Schoolmaster (Natural Science) (Chemistry principally). Honours
B.A., Natural Sciences, Cambridge, 1913.

W. J. S. Naunton.

S. Ruhemann.

H. J. H. Fenton.

C. T. Heycock.

W. G. Gledhill.

Gittins, James Mylam,

South Lynn, Limes Road, Folkestone.

Schoolmaster. B.Sc. Hons. Chem., 1906; M.Sc. (on Chemical Research),
1909; 1906 to 1908 Research Assist. to Dr. J. J. Sudborough (Professor
Chemistry, U.C.W., Aberystwyth); Investigator and Part Author of
following works on Esterification: T., 1908, 93, 210; 1909, 95, 315.

J. J. Sudborough.

Norman Picton.

T. Campbell James.

Alex. Findlay.

E. R. Thomas.

C. R. Bury.

Henderson, Frederick George,

44, Dene View, Wallsend-on-Tyne.

Analytical Chemist. Chief Chemist to the Walker and Wallsend Union Gas Company; Consulting Chemist to the Central Refining Works Co.; Formerly on the Scientific Staff of J. & H. S. Pattinson, Rexol Ltd., the Aluminium Corporation, Ltd., the Tharsis Sulphur and Copper Co.

J. T. Dunn.

Ernest F. Hooper.

N. H. Martin.

F. N. Binks.

F. W. Pittuck.

F. C. Garrett.

P. Phillips Bedson.

Henri, Victor,

Paris, 8 rue du Puits de l'Ermite.

Assistant Director of the Physiological Laboratory at the Sorbonne Paris.

William Ramsay.

Henry E. Armstrong.

George Senter.

T. Martin Lowry.

F. G. Donnan.

George Barger.

Hinkel, Leonard Eric,

"Bucklands," Old Oak Road, Acton.

Lecturer in Chemistry at University of London, King's College; B.Sc. (1st Class Hons.), London; Fellow of the Institute of Chemistry

John M. Thomson.

Patrick H. Kirkaldy.

Herbert Jackson.

P. A. Ellis Richards.

W. D. Halliburton.

Arthur W. Crossley.

Holt, Alfred,

32, Britain St., Bury, Lancs.

Paper Mill Chemist. London University Matriculation Certificate; Board of Education Certificate in Inorganic Chemistry, Stage III. (Theor. and Pract.); Organic Chemistry, Stage II. (Theor. and Pract.); 1st Class Honours, Cotton Bleaching; 2nd Class Honours, Cotton Dyeing; 1st Class Honours, Paper Manufacture (City and Guilds of London Institute); Silver Medallist, 1910.

Geo. M. Norman.

Jul. Hübner.

Harry Ingham.

Edmund Knecht.

William Dixon.

Jennings, John Cyril,

"Rosindell," Fairlop Road, Leytonstone, N.E.

Analytical Chemist. Educated at East London College; Studied Chemistry for Eight Years; Student at Battersea Polytechnic; Articled

to Leo Taylor, F.I.C., Public Analyst, for two years; Two and a-half years with large Firm of Oil Refiners and Distillers. At present holding position as Chief Assistant to Messrs. W. B. Dick & Co., London, Refiners and Distillers of Oils, Greases, and Turpentine.

C. Smith.

S. E. Davenport.

R. P. Hodges.

J. L. White.

J. Wilson.

Leighton, John Orron,
30, Albany Street, Hull.

Analyst, Bankside Oil Mills, Seed-Crushing Mill. Pupil and Assistant with Harry Thompson, F.C.S.; in charge of the Laboratory, Bankside Oil Mills; Specialising in Seed-Crushing, Oil and Agricultural work, and Investigating Manufacturing Processes in connection with the Oil Industry.

Harry Thompson.

R. J. Porter.

Arnold R. Tankard.

C. B. Newton.

Thomas Luxton.

Machin, Robert Ernest,
5, Redcliffe Road, South Kensington.

School Teacher. Graduate of London University; now engaged upon a Post-Graduate Course at Birkbeck College.

George Senter.

Fred Barrow.

Geoffrey Martin.

G. W. Clough.

Horace G. Stone.

Pollock, Ernest Ferguson,
Kirkland, Bonhill, Dumbartonshire.

Assistant in the Organic Chemistry Department of the University of Glasgow. Fellow of the Institute of Chemistry; Ph.D. (Jena); Associate of the Royal Technical College, Glasgow. Papers published: "Contributions to the Chemistry of the Terpenes. Part VIII. Dihydrocamphene and Dihydrobornylene" (with G. G. Henderson), *T.*, 1910, **97**, 1620; "Ueber Methylcyclohexenone" (with P. Rabe), *Ber.*, 1912, **45**, 2924.

T. S. Patterson.

Isidor M. Heilbron.

Cecil H. Desch.

G. G. Henderson.

Forsyth J. Wilson.

Jas. A. Russell Henderson.

Rai, Hashmat,
Chemical Buildings, Government College, Lahore (India).

B.A., 1906; M.Sc., Physics, 1908; M.Sc., Chemistry, 1910, all of the

Punjab University. Assistant Professor of Chemistry, Govt. College, Lahore.

F. G. Donnan.

R. E. Slade.

W. B. Tuck.

J. N. Collie.

Irvine Masson.

Roberts, Charles Edward,

St. John's Coll., Cambridge.

Student, engaged in Chemical research. 1st Class Nat. Sci. Trip. Part I.; 2nd Class Nat. Sci. Trip., Part II. (Chemistry); 2nd Class Honours, London, B.Sc. (Chemistry).

W. J. Pope.

H. J. H. Fenton.

W. H. Mills.

Charles T. Heycock.

F. E. E. Lamplough.

Robinson, Frederic,

The Hollies, Mile End, Stockport, Cheshire.

Chemist to Messrs. The Exors. of F. Robinson, Unicorn Brewery, Stockport. M.Sc. Tech.; A.I.C. Research Student, Manchester University. Desirous of joining to keep in touch with chemical research.

Jas. Grant.

H. F. Coward.

Edmund Knecht.

Stanley J. Peachey.

F. S. Sinnatt.

E. L. Rhead.

Rowbottam, Walter Edward,

23, Darville Road, Stoke Newington, London.

Analytical Chemist. I studied Chemistry for 2 years at Hackney Technical Institute and passed the Board of Education Examination on the Subject. For the past 3 years I have been articled pupil and assistant to Leo Taylor, Esq., F.I.C., C.C. Public Analyst for Hackney, Southend-on-Sea, etc. I am desirous of obtaining the Journal of the Society and availing myself of the privileges of Membership.

S. E. Davenport,

V. Lefebure.

Chas. A. Stamp.

J. J. Fox.

R. P. Hodges.

Charles A. Keane.

Thompson, Thomas William,

Queen Elizabeth's Grammar School, Gainsborough.

Schoolmaster. Late Scholar of Jesus College, Cambridge. 2nd Class Natural Science Tripos, Pt. I., 1909. Science Master, Queen Elizabeth's Grammar School, Faversham, 1909-1912. Science Master,

Queen Elizabeth's Grammar School, Gainsborough, since 1912. (B.A. 1909 ; M.A. 1913.)

H. J. H. Fenton.

F. E. E. Lamplough.

S. Ruhemann.

R. A. Scott Macfie.

F. W. Dootson.

W. H. Mills.

White, Alfred John,

"Hawes Down," West Wickham, Kent.

Schoolteacher. B.Sc. (Lond.), and Student in Chemistry for 3 years at Birkbeck College. Am desirous of keeping abreast with recent work in Chemistry.

George Senter.

Geoffrey Martin.

Fred Barrow.

G. W. Clough.

G. H. Martin.

The following Certificate has been authorised by the Council for presentation to ballot under Bye-Law I (3) :

Chattopadhyay, Probodha Chundra,

90, Maniktala Main Road, Harrison Road P.O., Calcutta.

Chemist, Bengal Chemical and Pharmaceutical Works, Limited, Calcutta. Worked as a Post-graduate student in the Presidency College under Dr. P. C. Rây after taking the M.A. degree in Chemistry. Formerly in charge of the Pharmaceutical and Sulphuric Acid Manufacture Departments of the Bengal Chemical and Pharmaceutical Works, Ltd., and at present in charge of the Research Laboratory and Perfumery Depts. of the said firm. Have designed some scientific apparatus, and have contributed original papers in the Journal of Society of Chemical Industry.

P. C. Rây.

J. B. Bhaduri.

Jatindranath Sen.

PROCEEDINGS
OF THE
CHEMICAL SOCIETY.

Vol. 30

No. 432.

Thursday, June 18th, 1914, at 8.30 p.m., Professor W. H. PERKIN, LL.D., F.R.S., President, in the Chair.

The PRESIDENT referred to the loss the Society had sustained, through death on June 6th, 1914, of Professor Dr. Adolf Lieben, who was elected an Honorary and Foreign Member on June 16th, 1892.

Messrs. H. C. Reynard and R. L. Collett were formally admitted Fellows of the Chemical Society.

Certificates were read for the first time in favour of

Frederick Raine Ennos, B.A., B.Sc., 98, Rector
Newington, N.

Leon Maurice Hirschberg, Ph.D., 20, Birchington,
End, N.

Benjamin Stanley Mellor, M.Sc., 42, Hill Crest Vi
Olin Freeman Tower, Ph.D., Adelbert College, C
U.S.A.

Arthur Henry Wardle, Ford House, Leek.

The following Certificate has been authorised by the Council for presentation to ballot under Bye-law I(3):

Ernest George, B.Sc., Victoria Square, King William's Town,
S. Africa.

Messrs. F. P. Dunn and R. Gaunt were elected Scrutators, and a ballot for the election of Fellows was held. The following were subsequently declared as duly elected:

Nicholas Alexander Aufilogoff.
 Harry Berry.
 Alfred Archibald Boon, D.Sc.
 Probodha Chundra Chattopadhyay, M.A.
 Stanley Winter Collins, B.Sc.
 Herbert William Cremer, B.Sc.
 John Vernell Cutler.
 Shanazar Galstaun Galstaun, B.A.
 James Mylam Gittins, M.Sc.
 Frederick George Henderson.
 Victor Henri.
 Leonard Eric Hinkel, B.Sc.

Alfred Holt.
 John Cyril Jennings.
 John Orron Leighton.
 Robert Ernest Machin, B.Sc.
 Ernest Ferguson Pollock, Ph.D.
 Hashmat Rai, B.A., M.Sc.
 Charles Edward Roberts, B.A., B.Sc.
 Frederic Robinson, M.Sc. Tech.
 Walter Edward Rowbottam.
 Thomas William Thompson, M.A.
 Alfred John White, B.Sc.

Of the following papers, those marked * were read:

***172. "Nitrogenous constituents of hops."**

By Alfred Chaston Chapman.

In the case of a number of samples of hops analysed, the total percentage of nitrogen varied from 1·7 to 4 per cent, the percentages of soluble nitrogen varying from 0·44 to 0·9 per cent. The nitrogenous substances soluble in hot water consisted of soluble proteins, albumoses, ammonium salts, amino-compounds and amides, bases precipitable by phosphotungstic acid, and unclassified nitrogenous substances not precipitated by that reagent. Results were given showing the proportions in which these various classes of compounds occur. In the course of the work, large quantities of hops and hop extract were worked with, and four distinct methods for the separation and isolation of the nitrogenous substances were employed. The following substances were isolated and identified: *l*-asparagine, aspartic acid, betaine, choline, histidine, hypoxanthine, and adenine. Of these, asparagine and choline have been previously detected.

Two other bases were obtained, but in quantities too small to permit of their complete identification. One of these, however, was almost certainly arginine. Although considerable quantities of hops of various growths were employed, in no case was morphine, or any alkaloid closely resembling it, obtained. Potassium nitrate was present in appreciable quantities.

DISCUSSION.

Dr. POWELL remarked, concerning the reference by Mr. Chapman to the alleged presence of morphine in hops, that no evidence had

ever been adduced to justify the assumption that this alkaloid occurs in either wild or cultivated hops. The fact was recalled that about thirty years ago a preparation was introduced under the name of "hopeine," which was first stated to have been obtained from "wild Virginian hops," and subsequently from "Arizona hops," but neither of these districts was known to produce hops in any amount. The so-called "hopeine" was examined by Ladenburg (*Ber.*, 1886, **19**, 783) and others, who found it to consist of morphine or a mixture of the latter with a more readily soluble base. Dr. B. H. Paul (*Pharm. J.*, 1886, [iii], **16**, 877) likewise showed it to be a variable product, consisting either chiefly of morphine or a mixture of morphine and cocaine, whilst in some samples the latter base predominated. The only presumption for the presence of morphine in hops appears thus to have been based on the statements concerning a product which was shown many years ago to have been of a purely fictitious character.

Mr. E. GRANT HOOPER inquired whether any investigation had been made of the solubility of the nitrogenous constituents of hops when a sugar or other carbohydrate solution was used instead of water. Considering that hops were chiefly used for brewing purposes, he thought that the solubility of the nitrogenous constituents in carbohydrate solutions was of some importance, and might be appreciably different from the solubility in water alone.

Mr. ROGERSON asked if the amount of betaine obtained by the lime method of extracting the hops was greater than the amount obtained by the other methods described. It was conceivable that some oxidation of choline might take place.

Mr. CHAPMAN said that he was aware of the episode to which Dr. Power had referred. So far as he knew, there was no evidence that certain kinds of wild hops did not contain small quantities of morphine or some similar alkaloid, but he thought it was quite clearly established that cultivated hops did not contain more than, at most, insignificant traces. Choline did not undergo conversion into betaine as readily as Mr. Rogerson seemed to imply, and having regard to the methods of extraction adopted in his (Mr. Chapman's) experiments, there could be no doubt that the betaine was actually present in the hops, and had not been formed from the choline during the process of examination. He had specially searched for the presence of tyrosine and guanine, but with negative results. He had, moreover, been unable to obtain any evidence of the presence of lysine.

- *173. "The isomerism of the oximes. Part IV. The constitution of the *N*-methyl ethers of the aldoximes and the absorption spectra of oximes, their sodium salts and methyl ethers." By Oscar Lisle Brady.

The author is of opinion that the constitution proposed by Angeli, Alessandri and Aizzi-Mancini (*Atti R. Accad. Lincei*, 1911, [v], 20, i, 546) for the *N*-methyl ethers of the oximes, namely, $R \cdot CH:N(CH_3):O$, is more in accordance with the facts than the

more generally accepted *iso*-oxime structure,
$$\begin{array}{c} R \cdot CH - N \cdot CH_3 \\ \diagdown \quad \diagup \\ O \end{array} .$$

The consideration of the absorption spectra of the oximes, their sodium salts, and their methyl ethers, obtained from benzaldehyde and *p*-nitrobenzaldehyde, supports the views of Baly, Tuck and Marsden (*T.*, 1910, 97, 571), that no trustworthy evidence can be obtained from spectroscopic considerations with regard to the structure of such compounds as the nitrophenols and their sodium salts.

- *174. "The wet oxidation of metals. Part III. The corrosion of lead." By Bertram Lambert and Herbert Edwin Cullis.

Metallic lead, made by Stas' method, was fractionated by distilling in a quartz tube in a vacuum, and the middle fraction taken. This fraction was then distilled again, in a vacuum, in an apparatus so constructed that the distilled metal could be brought into contact with pure water and pure oxygen.

It was found that corrosion took place very rapidly if the oxygen was allowed to come into contact with the lead and water within a few days after the distillation of the lead.

If, however, the lead was left in contact with the pure water in a vacuum for twelve months, and then oxygen allowed to enter, the rate of corrosion was very slow. The metal retained a silvery-white appearance for more than a week, and even after six months the coating of oxide was so thin that it gave rise to interference colours.

The electrolytic theory of corrosion was considered in connexion with lead.

- *175. "Studies in the camphane series. Part XXXV. Isomeric hydrazoximes of camphorquinone, and some derivatives of aminocamphor." By Martin Onslow Forster and Ernest Kunz.

In order to investigate the possibility of stereoisomerism among hydrazoximes of camphorquinone, a systematic attempt was made

to prepare the eight modifications required by theoretical considerations. Only two of these have been realised, however, namely, *camphorquinonehydrazoxime*, $C_8H_{14} \begin{smallmatrix} \text{C:N}\cdot\text{NH}_2 \\ | \\ \text{C:NOH} \end{smallmatrix}$, melting at 130° , from β -isonitrosoepicamphor, and the structural *isomeride*, $C_8H_{14} \begin{smallmatrix} \text{C:NOH} \\ | \\ \text{C:N}\cdot\text{NH}_2 \end{smallmatrix}$, melting at 142° , from unstable isonitroso-camphor. Several derivatives of these compounds were described, together with various materials prepared from aminocamphor in the hope of obtaining the missing isomerides by indirect methods.

176. "The velocities of combination of sodium derivatives of phenols with olefine oxides." By David Runciman Boyd and Ernest Robert Marle.

The velocities with which ethylene and propylene oxides combine with sodium derivatives of phenols have been determined, approximately, for twenty-five phenols by estimating the yields of glycol aryl ethers produced when the olefine oxides are heated with $N/20$ -alcoholic solutions of the phenolic salts.

The values found for $1/t \log 100/100-x$ vary in the case of ethylene oxide from 0.34 for ψ -cumenol to 0.0073 for *o*-nitrophenol, and in the case of propylene oxide from 0.13 for ψ -cumenol to 0.0035 for *o*-nitrophenol. The following general conclusions are drawn:

(1) The reactivity of the sodium derivative towards ethylene oxide is increased by the presence of positive groups, for example, $\cdot\text{CH}_3$, $\cdot\text{C}_3\text{H}_7$, $\cdot\text{CH}_2\cdot\text{CH}\cdot\text{CH}_2$, and diminished by the presence of negative groups, such as $\cdot\text{O}\cdot\text{CH}_3$, $\cdot\text{CH}\cdot\text{CH}\cdot\text{CH}\cdot\text{CH}\cdot$, $\cdot\text{Cl}$, $\cdot\text{Br}$, $\text{C}_6\text{H}_5\cdot\text{N}\cdot\text{N}\cdot$, $\cdot\text{CN}$, $\cdot\text{NO}_2$.

(2) In general, the reactivity diminishes with increase in the acidity of the phenol. 2:4:6-Trichlorophenol, however, forms an exception to this rule, its sodium salt having a much higher reactivity than would be expected.

(3) The phenols stand in almost the same order in the case of propylene as in the case of ethylene oxide. The most important exceptions are 2:4:6-trichloro- and 2:4:6-tribromo-phenol, α -naphthol, and *o*-chlorophenol. The sodium salts of these four phenols are much more reactive towards propylene oxide than would be anticipated from a consideration of the results obtained for the same phenols in the case of ethylene oxide.

(4) There is no evidence of steric hindrance in the case of diortho-substituted phenols. The process of combination in the case of ethylene, and particularly in that of propylene oxide, seems

rather to be facilitated by the presence of the two ortho-substituents.

Several new glycol aryl ethers were described.

177. "Colouring matters contained as glucoside in the flowers of some Indian plants." By Arthur George Perkin and Isaac Shulman.

These flowers, the description of which is given below, were specially collected in India, in the anticipation that they contained some quantity of dyestuff. This has not proved to be the case, the amount of colouring matter isolated being extremely small, and, indeed, not always sufficient for analysis. The method of examination in each instance has consisted of treating the concentrated alcoholic extract with water, removal of suspended waxy matter, digestion of the aqueous solution with boiling hydrochloric acid to hydrolyse the glucosides, and isolation of the colouring matter by means of ether. Incidentally, the use of sodium hydrogen carbonate solution has been found of much service in purifying minute amounts of these substances. To this the crude product dissolved in alcohol is added, and, after agitation, ether now removes a fairly pure compound.

Poinciana regia (Bengal).—Three hundred and fifty grams gave 0.31 gram of colouring matter, which crystallised in yellow needles, dissolved in alkalis with a yellow coloration, and proved to be quercetin. The acetyl compound, colourless needles, m. p. 194—196°, gave C=58.75; H=3.84 per cent. An extract of these flowers had practically no dyeing action on mordanted cotton.

Impatiens balsamina (Chansili Pass) yielded but a trace of substance, evidently kaempferol. It separated from acetic acid in needles, m. p. 275—278°, and gave with sulphuric acid a fluorescent solution, whereas the acetyl derivative, colourless needles (Found, C=61.18; H=4.06 per cent.), fused at about 120°, re-solidified, and finally melted at 181—183°.

Woodfordia floribunda.—Seven hundred grams gave 0.84 gram of crude colouring matter, and this consisted of two substances readily separated by means of alcohol. The sparingly soluble compound (0.61 gram) crystallised from pyridine in needles, and was recognised by analysis (Found, C=55.62; H=2.40), the melting point of the acetyl derivative (343—345°), and the Griessmayer reaction as ellagic acid. The soluble colouring matter (yellow needles, m. p. 285—291°), of which but a minute amount was available, was possibly an impure quercetin. It gave the general tests for this substance, but the acetyl compound, obtained in colourless needles, melted at 135—137°.

Erythrina stricta (vernacular name, "Konkathet"), from Chief Conservator of Forests (Mamyo, Burmah), gave a trace of kaempferol insufficient for analysis, which was recognised by the peculiar melting point of the acetyl compound (see above), the fluorescence of its sulphuric acid solution, and its general properties.

For the samples of these flowers, the authors are indebted to Mr. D. Hooper, Reporter on Economic Products to the Government of India.

Mention may also be made here of the flowers of the common fuschia, *F. macrostema globosa*, which was found to yield traces of ellagic acid, identified by means of the acetyl compound (m. p. 343—345°), and quercetin, which gave acetylquercetin, m. p. 193—195°.

178. "Note on quercitrin." By Arthur George Perkin.

The statements (this vol., p. 151; T., 1914, 105, 1411) that quercitrin has the formula $C_{21}H_{20}O_{11}$ and m. p. 183—185°, considered by the author at the time to be novel, are, in reality, not so, these facts having been previously ascertained by Brauns (*Arch. Pharm.*, 1904, 242, 561) and C. W. Moore (P., 1910, 26, 182).

179. "A new chlorocamphor." (Preliminary note.)

By Thomas Martin Lowry and Victor Steele.

By using the method described by Kipping in 1905 (P., 21, 125), α -chlorocamphor has been converted into the stereoisomeric α' -chlorocamphor, which melts at 117°. A direct comparison gave the following values for the specific rotatory powers of the two compounds in alcoholic solution (5 grams per 100 c.c.):

	Li 6708.	Na 5893.	Hg 5461.	Hg 4359.
α -Chlorocamphor	70.0	97.0	119.2	242.9
α' -Chlorocamphor.....	27.5	41.4	54.1	140.9

180. "Ideal refractivities of gases."

By William Jacob Jones and James Riddick Partington.

An equation has been deduced which permits of the correction of observed refractivities of gases at normal pressure, $P_0=760$ mm., and absolute temperature, $T_0=273.09$, for the deviations of the gases from the ideal state. This equation, which is based on D. Berthelot's characteristic equation, is:

$$\mu' - 1 = (\mu - 1) \left[1 + \frac{9}{128} \pi \tau (1 - 6\tau^2) \right]$$

where μ and μ' are the observed and ideal refractive indices respectively, $\pi = P_0/P_c$, $\tau = T_c/T_0$ (P_c and T_c are the critical constants). In the case of the permanent gases, the correction is inconsiderable, but it is appreciable in the case of the more easily liquefiable gases.

Gas.	Wave-length.	Refractive index at N.T.P.	Ideal refractive index.
Hydrogen	589	1.0001392	1.0001393
Methane.....	589	1.0004410	1.0004403
Xenon	486	1.0007130	1.0007078
Carbon dioxide.....	589	1.0004498	1.0004467
Sulphur dioxide	589	1.0006760	1.0006628
Chlorine.....	589	1.0007730	1.0007608
Cyanogen	436	1.0008710	1.0008536

181. " α -Bromonaphthalene: its physical properties and its application to the determination of water in moist alcohol." By Marian Jones and Arthur Lapworth.

The work referred to in a previous note on α -bromonaphthalene has been confirmed and extended (compare Crabtree and Lapworth, P., 1912, **28**, 264).

The temperatures at which homogeneous mixtures of α -bromonaphthalene and moist alcohol separate into two phases can be determined with exceptional readiness, and as these temperatures are very sensitive to alterations in the proportion of water present the authors use α -bromonaphthalene for ascertaining the composition of moist alcohol within the range, $H_2O = 1.45-10.3$ per cent. Data were quoted by means of which the percentage of water in small quantities of moist alcohol may be determined in a very simple manner, and with an error of less than 0.03 per cent.

182. "Colour and constitution of azo-compounds. Part VI." By John Theodore Hewitt, Gladys Ruby Mann, and Frank George Pope.

In previous communications attention has been drawn to the marked changes in colour which occur when solutions of paranitrated azophenols are rendered alkaline; and certain chemical evidence has been adduced in favour of the assumption that the salts possess a quinonoid structure.

Considering the possibility of enolisation taking place when an azo-compound contains a ketonic as well as a hydroxyl group, a number of azophenols have been prepared by diazotising *p*-aminoacetophenone and *p*-aminobenzophenone, and coupling them with phenol, *p*-cresol, and the naphthols. Alcoholic solutions of these compounds exhibit marked colour changes on addition of alkali.

183. "Studies in phototropy and thermotropy. Part IV. *o*-Nitrobenzylidenearylamines and their photoisomeric change." By Alfred Senier and Rosalind Clarke.

The authors have made a further search for examples of phototropy and thermotropy. The bases examined were *o*-nitrobenzylidenearylamines. All are thermotropic, and several exhibit phototropy. Prolonged exposure to light leads, however, to a non-reversible change in colour, and in many cases to a change in melting point. This change is ascribed to dimorphism. The interesting fact was discovered that these bases undergo photoisomeric change, like the compounds studied by Ciamician and Silber (*Ber.*, 1901, **34**, 2040), and that examined by Sachs and Kempf (*Ber.*, 1902, **35**, 2704).

184. "Contributions to the chemistry of the terpenes. Part XVIII. Camphenanic acid and its isomerides." By George Gerald Henderson and Maggie Millen Jeffs Sutherland.

The four isomeric acids of the formula $C_9H_{15}\cdot CO_2H$, which have been obtained by the oxidation both of camphene and of bornylene, were converted into their *methyl* esters; these are somewhat viscid, colourless liquids, which all boil at about the same temperature, 103—104°/22 mm. The esters of camphenilanic, *isocamphenilanic*, and camphenanic acids yield the respective acids when hydrolysed, but the product obtained on hydrolysis of the supposed ester of *isocamphenanic* acid was found to be a mixture of camphenilanic and *isocamphenilanic* acids. It is concluded that *isocamphenanic* acid is, in reality, a mixture of camphenilanic and *isocamphenilanic* acids, or else is converted into these acids during esterification.

Each of the esters, when treated with sodium and alcohol, yields the same alcohol, *camphenilanol*, $C_9H_{15}\cdot CH_2\cdot OH$, a crystalline solid melting at 77°, which is converted into camphenilanaldehyde by oxidation with chromic acid mixture. Its *hydrogen phthalate* crystallises in colourless plates, m. p. 153°, and its *p*-nitrobenzoate in yellow needles, m. p. 90°.

During the reduction of each of the esters, a small quantity of an acid was produced, and in every case this proved to be *isocamphenilanic* acid. Thus camphenilanic and camphenanic acids can be transformed into *isocamphenilanic* acid by a method different from those formerly described.

185. "2:3-Dibromonaphthalene." (Preliminary note.)

By William Palmer Wynne.

Different views have been held regarding the composition of the product obtained by dibrominating naphthalene; 1:4- and 1:5-dibromonaphthalenes have been isolated from it, but the nature of a third substance, m. p. 68° (*circa*), is still in doubt. Guareschi, who first recorded its presence in the dibromination product (*Gazzetta*, 1881, **11**, 542), and Canzoneri, who obtained it by the interaction of phosphorus tribromide and bromo- β -naphthol (*ibid.*, 1882, **12**, 424), regard it as a single substance, but Armstrong and Rossiter consider it to be a definite compound of 1:4- and 1:5-dibromonaphthalene (P., 1891, **7**, 184). On the assumption that it is an individual, the only available structure is that of the 2:3-derivative, although this orientation is improbable on several grounds. For example, it would be the one exception to the rule that dibromonaphthalenes melt at temperatures higher than the corresponding dichloro-derivatives, 2:3-dichloronaphthalene melting at 119.5° .

Through the kindness of the Badische Anilin- & Soda-Fabrik in supplying the author with 3-amino- β -naphthoic acid, an opportunity has arisen for the preparation of 2:3-dibromonaphthalene, hitherto unknown. The following compounds were described: 3-bromo- β -naphthoic acid, $C_{10}H_6Br \cdot CO_2H$, needles, m. p. 220° ; the methyl ester, needles, m. p. 67° ; the hydrazide, minute needles, m. p. 218° ; the urethane, needles, m. p. 114° ; 3-bromo-2-naphthylamine, $C_{10}H_6Br \cdot NH_2$, scales, m. p. 168° , and its acetyl derivative, cluster of scales, m. p. 172° . 2:3-Dibromonaphthalene, which forms silvery, rectangular scales, m. p. 140° , has the same melting point as recorded for the 2:7-derivative by Jolin (*Bull. Soc. chim*, 1877, [ii], **28**, 514), but as the method used by him is open to criticism, the preparation of the 2:7-compound is being undertaken for the purpose of comparison by reactions which avoid the use of phosphorus pentabromide at high temperatures.

186. "Calcium nitrate. Part III. The three-component system: calcium nitrate-lime-water." By Henry Bassett, jun., and Hugh Stott Taylor.

The conditions of equilibrium in this system have been studied at 25° and at 100° .

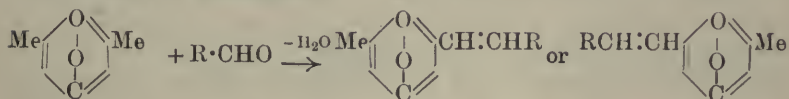
The compounds capable of existing in equilibrium with solution at 25° are: $Ca(OH)_2$, $Ca_2N_2O_7 \cdot 3H_2O$, and $Ca(NO_3)_2 \cdot 4H_2O$; whilst at 100° they are: $Ca(OH)_2$, $Ca_2N_2O_7 \cdot 2H_2O$, $Ca_2N_2O_7 \cdot \frac{1}{2}H_2O$, and

$\text{Ca}(\text{NO}_3)_2$. The series of solid solutions $\text{CaO}, x\text{N}_2\text{O}_5, y\text{H}_2\text{O}$, which according to Cameron and Robinson (*J. physical Chem.*, 1907, **11**, 273) exists at 25° , has not been confirmed. It has, on the contrary, been shown that the region of solid solutions described by these authors is really a portion of the region where $\text{Ca}(\text{OH})_2$ is the stable solid phase.

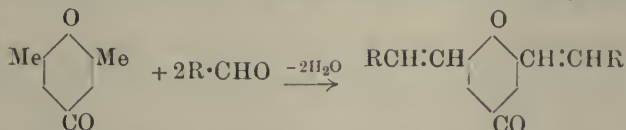
It was suggested that the presence of a trace of magnesia in the calcium nitrate used by Cameron and Robinson may have led them to erroneous conclusions.

187. "Some arylidenedimethylpyrones and their salts." By Alfred Archibald Boon, Kenneth John McKenzie, and John Trotter.

Not long after Collie suggested the bridged formula for dimethylpyrone (T., 1904, **85**, 973), one of the authors was induced to study the action of furfuraldehyde on this base with the view of effecting the following condensation:



For this purpose many experiments were undertaken under varying conditions, but in every case both the methyl groups of dimethylpyrone took part in the reaction. More recently (P., 1910, **26**, 95) it was indicated that the condensation of dimethylpyrone with an aldehyde could be represented by the following scheme:



and that the resulting coloured base formed intensely coloured salts with acids, the colour of the salts depending on the nature of the aldehyde used in condensation as well as that of the acids employed in their production. Attention is now called to three of these bases, namely, *bisfurylidenedimethylpyrone*, *bisbenzylidenedimethylpyrone*, and *bisanisylidenedimethylpyrone*, and some of their salts. All these salts undergo hydrolysis when boiled with water.

In a subsequent paper the constitution of the various compounds indicated here will be discussed by one of the authors with other collaborators.

Each of the bases just mentioned was prepared by the action of the aldehyde on dimethylpyrone in the presence of alcoholic

sodium hydroxide. *Bisfurylidenedimethylpyrone*, $C_{17}H_{12}O_4$, is yellow, and melts at 200° . Each of the following salts, which are red, was obtained in the following way: A 20 per cent. solution of the acid was allowed to act on the base dissolved in an alcohol, in the case of the hydrochloride amyl alcohol being used, and for the other salts methyl alcohol. Each salt was washed with light petroleum, and dried in a vacuum.

The *hydrochloride*, $C_{17}H_{12}O_4 \cdot HCl$, m. p. 196° (becoming yellow at about 115°).

Found: $HCl = 11.29$. Calc., $HCl = 11.50$ per cent.

The *nitrate*, $C_{17}H_{12}O_4 \cdot HNO_3$, m. p. $166-167^\circ$ (changes colour at 102°).

Found: $HNO_3 = 18.02$. Calc., $HNO_3 = 18.38$ per cent.

The *sulphate*, $C_{17}H_{12}O_4 \cdot H_2SO_4$, m. p. $202-203^\circ$.

Found: $H_2SO_4 = 24.70$. Calc., $H_2SO_4 = 25.92$ per cent.

Bisbenzylidenedimethylpyrone, $C_{21}H_{16}O_2$, forms faintly yellow, crystalline flakes, melting at 168° . The following yellow salts were isolated, and in the preparation of each of them the respective acids were allowed to act on the base dissolved in chloroform.

For the nitrate a 20 per cent. solution of nitric acid was used, and for the hydrochloride and the sulphate, acids having respectively D 1.11 and D 1.32 were employed.

The *hydrochloride*, $C_{21}H_{16}O_2 \cdot HCl$, m. p. $166-167^\circ$.

Found: $HCl = 10.65$. Calc., $HCl = 10.85$ per cent.

The *nitrate*, $C_{21}H_{16}O_2 \cdot HNO_3$, m. p. $141-142^\circ$ (with decomposition).

Found: $HNO_3 = 16.98$. Calc., $HNO_3 = 17.38$ per cent.

The *sulphate*, $C_{21}H_{16}O_2 \cdot H_2SO_4$, m. p. $155-156^\circ$, darkens about 104° .

Found: $H_2SO_4 = 25.80$. Calc., $H_2SO_4 = 24.68$ per cent.

Bisanisylidenedimethylpyrone, $C_{23}H_{20}O_4$, forms faintly yellow, crystalline flakes, melting at 199° . With the exception of the deliquescent, bright red sulphate, the inorganic and organic salts prepared from this base lose weight when exposed to the air, during periods varying from eleven to thirty days, the nitrate being most stable, the formate losing all its acid, and the hydriodide becoming dark violet.

Inorganic Salts.—The hydrofluoride is yellow, but all the other salts are red. Unless otherwise stated, each salt was prepared by allowing an excess of the concentrated acid dissolved in alcohol to act on a boiling alcoholic solution containing 2 grams of the base. In some cases the freshly prepared salt was dried and imme-

diately analysed (for example, the bright red sulphate), whilst in other cases it was either washed with alcohol (for example, the nitrate) or recrystallised from methyl alcohol (for example, the hydrochloride) before being dried and analysed.

The *hydrochloride*, $C_{23}H_{20}O_4 \cdot HCl$, m. p. 147—148°.

Found: $HCl = 8.89$. Calc., $HCl = 9.20$ per cent.

The *hydrobromide*, $C_{23}H_{20}O_4 \cdot HBr$ (melting point not sharp).

Found: $HBr = 18.08$. Calc., $HBr = 18.36$ per cent.

The *hydrofluoride*, $C_{23}H_{20}O_4 \cdot HF$, decomposes when heated. In its preparation at least four times the calculated quantity of acid must be used. The salt when freshly prepared is red, but on drying in a vacuum over sodium hydroxide until its weight is constant it becomes yellow,

Found: $HF = 5.23$. Calc., $HF = 5.26$ per cent.

(From various experiments the action of hydrofluoric acid on the base appears to be abnormal.)

The *nitrate*, $C_{23}H_{20}O_4 \cdot HNO_3$, decomposes at 146°.

Found: $HNO_3 = 14.78$. Calc., $HNO_3 = 14.89$ per cent.

The *sulphate*, $(C_{23}H_{20}O_4)_2 \cdot H_2SO_4$, forms dark red crystals, m. p. 86—87°. The calculated quantity of concentrated sulphuric acid mixed with 10 c.c. of alcohol was used in its preparation.

Found: $H_2SO_4 = 12.25$. Calc., $H_2SO_4 = 11.98$ per cent.

The *sulphate*, $C_{23}H_{20}O_4 \cdot H_2SO_4$, bright red crystals, m. p. 101°. To a solution containing 50 c.c. of alcohol and 20 c.c. of concentrated sulphuric acid 2 grams of the base were added, and the mixture was heated for half-an-hour on a water-bath.

Found: $H_2SO_4 = 21.42$. Calc., $H_2SO_4 = 21.39$ per cent.

The *platinichloride*, $(C_{23}H_{20}O_4)_2 \cdot H_2PtCl_6$.—A slight excess of a concentrated alcoholic solution of platinic chloride was added to a boiling alcoholic mixture containing the base and excess of concentrated hydrochloric acid.

Found: $Pt = 17.11$. Calc., $Pt = 17.25$ per cent.

Organic Salts.—These are mostly yellow compounds, but a formate, a tartrate, and the picrate are red, whilst the salicylate is yellowish-red.

The *formate*, $C_{23}H_{20}O_4 \cdot (CH_2O_2)_2$, is a red salt, m. p. 99°, unstable when exposed to the air, becoming yellow, and finally losing all its acid. It is prepared by heating a solution of the base in pure formic acid on a water-bath, then allowing the solution to remain at the ordinary temperature, washing the salt with 50 per cent. formic acid, drying, and immediately analysing.

Found: $CH_2O_2 = 19.62$. Calc., $CH_2O_2 = 20.35$ per cent.

The *formate*, $C_{23}H_{20}O_4 \cdot CH_2O_2$, consists of yellow, hair-like crystals, and suffers decomposition when heated. It is obtained by the action of 90 per cent. formic acid on the base.

Found: $CH_2O_2 = 11.20$. Calc., $CH_2O_2 = 11.33$ per cent.

The *acetate*, $C_{23}H_{20}O_4 \cdot C_2H_4O_2$, forms yellow, hair-like crystals, and is obtained by gently warming a solution of the base in 90 per cent. acetic acid, and allowing the mixture to remain at the ordinary temperature. The crystals were washed with 50 per cent. acetic acid, dried, and immediately analysed.

Found: $C_2H_4O_2 = 14.44$. Calc., $C_2H_4O_2 = 14.30$ per cent.

The *oxalate*, $(C_{23}H_{20}O_4)_2 \cdot C_2H_2O_4$, which forms yellow needles, was obtained by adding a slight excess of the calculated quantity of anhydrous oxalic acid to a solution of the base dissolved in toluene (some alcohol being added to keep the base in solution). The mixture was boiled for six hours on the water-bath, and then allowed to cool at the ordinary temperature.

Found: $C_2H_2O_4 = 11.75$. Calc., $C_2H_2O_4 = 11.11$ per cent.

The *oxalate*, $C_{23}H_{20}O_4 \cdot C_2H_2O_4$, which separates in yellow crystals, m. p. $174-175^\circ$, was prepared by gradually adding 1 gram of anhydrous oxalic acid to a boiling toluene solution of 2 grams of the base. The solution was allowed to remain at the ordinary temperature after being boiled for six hours.

Found: $C_2H_2O_4 = 19.62$. Calc., $C_2H_2O_4 = 20.00$ per cent.

The *tartrate*, $(C_{23}H_{20}O_4)_2 \cdot C_4H_6O_6$, forms red crystals, and was obtained in a manner similar to that employed for the preparation of the corresponding oxalate.

Found: $C_4H_6O_6 = 17.45$. Calc., $C_4H_6O_6 = 17.24$ per cent.

The *succinate*, $(C_{23}H_{20}O_4)_2 \cdot C_4H_6O_4$, is yellow, and the *salicylate*, $(C_{23}H_{20}O_4)_2 \cdot C_7H_6O_3$, yellowish-red. These were obtained by heating the base for a number of hours with a concentrated alcoholic solution of the respective acids. In the case of the salicylate, the alcohol contained about 5 per cent. of toluene.

Found: $C_4H_6O_4 = 14.65$. Calc., $C_4H_6O_4 = 14.42$ per cent.

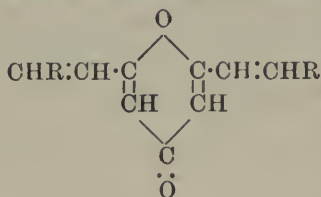
Found: $C_7H_6O_3 = 28.57$. Calc., $C_7H_6O_3 = 27.71$ per cent.

The *picrate*, $C_{23}H_{20}O_4 \cdot C_6H_3O_7N_3$, prepared by adding an alcoholic solution of picric acid to a boiling alcoholic solution of the base, forms red needles, m. p. 211° .

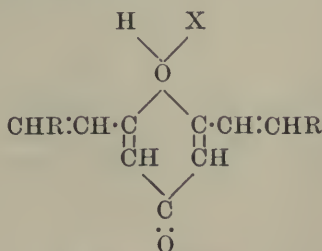
Found: $N = 7.62$. Calc., $N = 7.13$ per cent.

188. "The constitution of the arylidenedimethylpyrones and their salts." By Alfred Archibald Boon, Forsyth James Wilson, and Isidor Morris Heilbron.

The authors have examined the absorption spectra of bis-*p*-methoxybenzylidenedimethylpyrone, bisbenzylidenedimethylpyrone, and bisfurfurylidenedimethylpyrone. They find that the absorption curves of these substances are all practically identical, and, moreover, are very similar to the curve of the alcohol compound of dimethylpyrone. They therefore conclude that the arylidenedimethylpyrones possess symmetrical formulæ of the type:

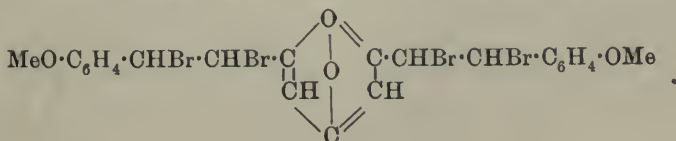


The absorption curves of the salts which these arylidenedimethylpyrones form with acids show two bands, a small colour band with head about $\lambda 1/2200$, and a large, well-defined band quite similar in intensity and position to the parent substances. The authors therefore believe that these salts are structurally similar to the free arylidenedimethylpyrones, thus:



(X=acidic radicle.)

On bromination, bis-*p*-methoxybenzylidenedimethylpyrone yields a tetrabromo-additive product, which does not form salts with acids, and, like dimethylpyrone, shows only general absorption. Accordingly, the authors ascribe to this compound the bridged structure:



The addition of bromine apparently has the effect of making the whole molecule too acidic for salt-formation with acids, as is the case with diacetyldimethylpyrone (compare Collie, T., 1904, 85, 971).

The authors conclude from these results that acidic or weakly basic pyrones, such as those examined by Baly, Collie, and Watson (T., 1909, 95, 144), possess bridged structures, whilst the arylidene-dimethylpyrones, which are more basic in character, yielding as they do stable salts with acids, possess symmetrical structures.

189. "The constituents of the flowers of *Anthemis nobilis*."

By Frederick Belding Power and Henry Browning, jun.

The material employed for this investigation consisted of the flower-heads of *Anthemis nobilis*, Linné, collected from plants grown in Belgium.

Apart from the essential oil yielded by distillation with steam, the flowers were found to contain the following definite compounds: (1) 3:4-dihydroxycinnamic acid; (2) apigenin, $C_{15}H_{10}O_5$; (3) a glucoside of apigenin, $C_{21}H_{20}O_{10} \cdot H_2O$, which yields an hexaacetyl derivative, $C_{33}H_{32}O_{16} \cdot 4H_2O$; (4) choline, $C_5H_{15}O_2N$; (5) *i*-inositol, $C_6H_6(OH)_6$; (6) triacontane, $C_{30}H_{62}$; (7) taraxasterol, $C_{29}H_{47} \cdot OH$; (8) a phytosterolin (m. p. 280—283°); (9) a mixture of fatty acids, consisting of cerotic, stearic, palmitic, oleic, and linolic acids. The flowers contained, furthermore, a considerable quantity of sugar, which yielded *d*-phenylglucosazone (m. p. 208—210°). The amount of fatty and resinous material, from which some of the above-mentioned substances were obtained, was equivalent to about 7.4 per cent. of the weight of flowers employed.

The bitter taste of chamomile flowers appears to be due to dark-coloured, amorphous material, and not to any well-defined constituent.

190. "The constituents of *Clematis vitalba*."

By Frank Tutin and Hubert William Bentley Clewer.

The material employed for this investigation consisted of the flowering branches of *Clematis vitalba*, Linné, which had been specially collected for the purpose.

Preliminary tests showed the absence of any alkaloid, and that only a trace of volatile material was present.

An alcoholic extract of the dried and ground material yielded, in addition to much chlorophyll and resin, the following definite compounds: (1) 3:4-dihydroxycinnamic acid; (2) caulosapogenin,

$C_{42}H_{66}O_6$; (3) a *saponin*, $C_{54}H_{86}O_{16}$, which proved to be a new glucoside of caulosapogenin; (4) dextrose; (5) myricyl and ceryl alcohols; (6) hentriacontane, $C_{31}H_{64}$; (7) a phytosterol; (8) a phytosterolin, which apparently consisted essentially of stigmasterol glucoside; (9) melissic, cerotic, and palmitic acids, together with a mixture of unsaturated acids, consisting largely of linolic acid, and an acid, $C_{22}H_{44}O_2$ (m. p. 69.5°), apparently isomeric with behenic acid.

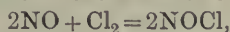
The statements regarding the irritant properties of *Clematis vitalba* cannot be confirmed.

191. "A magnetic study of compounds of water and of aqueous solutions." By Francis William Gray and William Milne Birse.

For the constitution of compounds like copper sulphate pentahydrate, suggestions based on magnetic measurements were made, and a magnetic study of benzoic, phthalic, maleic, succinic, and camphoric acids and their anhydrides was also described. The magnetic properties of solutions were discussed, and it was shown that aqueous potassium ferricyanide solutions obey the law of additivity throughout the whole range of concentrations. A value for the susceptibility of potassium ferricyanide is thus obtained.

192. "The rate of combination of gaseous nitric oxide and chlorine." By Joseph Edward Coates and Ada Finney.

A study has been made of the kinetics of the gas reaction



which proceeds with measurable velocity at the ordinary temperature. Known quantities of pure chlorine and nitric oxide were rapidly mixed in a glass bulb kept at constant temperature, and the gradual change of pressure at constant volume was followed by means of a mercury manometer connected with the reaction-vessel by a glass capillary tube filled with nitrogen. On mixing the gases, the temperature rose a few degrees, but soon fell to a constant value. The reaction was half completed in about five to six minutes. Satisfactory velocity constants were obtained only by the use of an equation for reactions of the third order. This is in agreement with the ordinary chemical equation, and constitutes a well-defined example of a "pure" (the walls of the vessel are almost certainly without influence) gas reaction of the third order; such reactions, as is well known, are extremely rare.

193. "Carajura and chica red." (Preliminary note.)

By Arthur George Perkin.

"Carajura," a rare pigment, considered to be identical with "Chica red" (compare Erdmann, *Jahresber.*, 1857, 487), is said to be prepared by the Indians of Central America from *Bigonia chica*. The material examined, obtained through the kindness of Messrs. Wright, Layman, and Umney, contains a small quantity of the calcium compounds of at least two colouring matters, which have either been precipitated on, or intermingled with, a substance of the nature of ground bark or peat. After treatment with hot dilute hydrochloric acid, alcohol removes the colouring matters in the form of a resin, and from this, by means of boiling benzene, *carajurin* is isolated. This compound, to which the formula $C_{18}H_{16}O_5$ has been provisionally assigned (Found, C=69.09; H=5.28), separates in ruby needles, melting at 204—206°, soluble in boiling dilute alkali with a red colour, and is nearly devoid of dyeing properties. With mineral acids, it very readily yields oxonium salts, crystallising in bright, orange needles, of which the *sulphate*, probably $C_{18}H_{16}O_5 \cdot H_2SO_4 \cdot H_2O$ (Found, C=50.67; H=4.35), is the most stable, the *hydrobromide* and *hydrochloride* being decomposed at 100°. From the hydrochloride, a *platinichloride* was prepared. Cold acetic anhydride with a trace of pyridine, after two days, gives an almost colourless *acetyl* compound, crystallising in needles, whereas bromine gives an immediate precipitate with carajurin in acetic acid, which, when boiled with this solvent, separates in orange needles. Hydriodic acid converts carajurin, with loss of two molecules of methyl iodide, into *carajuretin hydriodide*, bright scarlet needles, stable in the presence of cold water, and from this, by means of cold pyridine, *carajuretin*, probably $C_{16}H_{12}O_5$, scarlet needles melting above 330°, and soluble in alkalis with a reddish-violet colour, is produced. By dry distillation, carajurin evolves a trace of aromatic oil, resembling anisaldehyde in odour, and when fused with alkali, *p*-hydroxybenzoic acid, and a colourless *substance*, melting at 185—187°, as yet unidentified, are obtained. In many respects carajurin resembles the anhydrohydroxybenzopyranol compounds described by Bülow and Wagner (*Ber.*, 1901, **34**, 1199).

That portion of the alcoholic extract insoluble in benzene yields to ether *carajurone*, isolated as a scarlet powder, which readily assumes a beetle-green lustre, and possesses strong dyeing properties. Analysis indicates the presence of more oxygen in this compound than in carajurin. A small amount of a similar, but brighter, lake from British Guiana, and obtained from the leaves

of a "bushrope," gave a colouring matter dyeing also alizarin-like shades. This lake, considered to be "chica red," appears to differ in some respects from the "carajura" above described.

194. "The interaction of nitric acid and the sulphides of β -naphthol."

By Charles Graham Hutchison and Samuel Smiles.

When treated with nitric acid under suitable conditions, naphthasulphonium-quinone yielded a *mononitro*-derivative, which was converted into a *phenylhydrazone* and into *chloronitro-naphthathioxin*. Interaction of the *isosulphide* and nitric acid furnished the same nitro-quinone in almost quantitative yield, but the normal sulphide, even under mild conditions, gave only a very small quantity of this nitro-compound with a relatively large amount of dinitro- β -naphthol. Experiments were also quoted to show that the conversion of either sulphide into the quinone involves a loss of two atoms of hydrogen per molecule.

195. "Dinaphthathioxonium salts."

By Brojendranath Ghose and Samuel Smiles.

It was shown that, whilst acetyl chloride reacts with naphthasulphonium-quinone, yielding chlorodinaphthathioxin, acetyl iodide furnishes *dinaphthathioxonium iodide*. The latter substance was converted into dinaphthathioxin by means of sodium thiosulphate. Other salts of dinaphthathioxonium were obtained by interaction of acids and the corresponding sulfoxides, the change being parallel to that previously observed in the phenazthionium, carbothionium, and thiothionium series.

The following note has been received since the meeting:

196. "Alizarin α -methyl ether."

By Josef Oesch and Arthur George Perkin.

Alizarin α -methyl ether, which is present in Chay root, *Odenlandia umbellata* (T., 1893, **64**, 1160; 1907, **91**, 2068), and contains the methoxy-group in the peri-position with respect to the carbonyl group, has been prepared in small quantity by the action of an ethereal solution of diazomethane on a nitrobenzene solution of monoacetylalizarin and subsequent removal of the acetyl group (T., 1899, **75**, 447). It was obtained in needles melting at 117—178°, gave the acetyl compound melting at 211—213°, and possessed the characteristic properties of the natural product.

ADDITIONS TO THE LIBRARY.

I. *Donations.*

Hale, Arthur James. The synthetic use of metals in organic chemistry. London 1914. pp. xi+169. 4s. 6d. net. (*Recd.* 21/5/14.) From the Publishers: Messrs. J. and A. Churchill.

Harden, Arthur. Alcoholic fermentation. 2nd edition. London 1914. pp. vi+156. 4s. net. (*Recd.* 15/6/14.)

From the Publishers: Messrs. Longmans, Green and Co.

Philip, James C. Physical chemistry. Its bearing on biology and medicine. 2nd edition. London 1913. pp. vii+326. 7s. 6d. net. (*Recd.* 4/6/14.)

II. *By Purchase.*

Apolant, H. [and others]. Paul Ehrlich. Eine Darstellung seines wissenschaftlichen Wirkens. Festschrift zum 60 Geburtstage des Forschers. Jena 1914. pp. viii+668. ill. M.16.—. (*Recd.* 17/6/14.)

Cambridge, Percy John. The fæces of children and adults. Their examination and diagnostic significance with indications for treatment. Bristol 1914. pp. viii+516. ill. 17s. 6d. net. (*Recd.* 17/6/14.)

Ehrlich, Paul. See Apolant, H.

INFORMAL MEETING.

The Rooms of the Society will be open for an informal meeting of the Fellows on Thursday, October 22nd, 1914, from 8 to 10 p.m. Further particulars will be announced in due course.

THE LIBRARY.

The Library will be closed for Stocktaking from Monday, August 17th, until Saturday, August 29th, 1914, inclusive.

Fellows are particularly requested to return all Library Books in their possession not later than Wednesday, August 12th.

LIST
OF THE
OFFICERS AND FELLOWS
OF
THE CHEMICAL SOCIETY.
Founded, 1841.
INCORPORATED BY ROYAL CHARTER, 1848.

CORRECTED TO JULY, 1913.

BURLINGTON HOUSE,
LONDON, W.
1913.

OFFICERS AND COUNCIL,

ELECTED MARCH 14th, 1913.

PRESIDENT.

WILLIAM HENRY PERKIN, LL.D., Sc.D., F.R.S.

VICE-PRESIDENTS

WHO HAVE FILLED THE OFFICE OF PRESIDENT :

HENRY EDWARD ARMSTRONG, Ph.D.,
LL.D., F.R.S.

ALEXANDER CRUM BROWN, D.Sc.,
LL.D., F.R.S.

SIR WILLIAM CROOKES, O.M., D.Sc.,
F.R.S.

SIR JAMES DEWAR, M.A., LL.D.,
F.R.S.

HAROLD BAILY DIXON, M.A., Ph.D.,
F.R.S.

PERCY FARADAY FRANKLAND,
Ph.D., LL.D., F.R.S.

AUGUSTUS GEORGE VERNON HAR-
COURT, M.A., D.Sc., F.R.S.

RAPHAEL MELDOLA, D.Sc., LL.D.,
F.R.S.

HUGO MÜLLER, Ph.D., LL.D., F.R.S.
WILLIAM ODLING, M.A., M.B., F.R.S.

SIR WILLIAM RAMSAY, K.C.B., LL.D.,
F.R.S.

JAMES EMERSON REYNOLDS, Sc.D.,
M.D., F.R.S.

THE RIGHT HONOURABLE SIR HENRY
ENFIELD ROSCOE, LL.D., F.R.S.

SIR EDWARD THORPE, C.B., LL.D.,
F.R.S.

SIR WILLIAM AUGUSTUS TILDEN,
D.Sc., F.R.S.

VICE-PRESIDENTS :

HERBERT BRERETON BAKER, M.A.,
D.Sc., F.R.S.

GEORGE THOMAS BEILBY, LL.D.,
F.R.S.

HORACE TABBERER BROWN, LL.D.,
F.R.S.

EDMUND JAMES MILLS, D.Sc., LL.D.,
F.R.S.

GILBERT THOMAS MORGAN, D.Sc.
WILLIAM JACKSON POPE, M.A.,

F.R.S.

TREASURER :

ALEXANDER SCOTT, M.A., D.Sc., F.R.S.

SECRETARIES :

SAMUEL SMILES, D.Sc.

JAMES CHARLES PHILIP, M.A.,
D.Sc., Ph.D.

FOREIGN SECRETARY :

ARTHUR WILLIAM CROSSLEY, D.Sc., Ph.D., F.R.S.

ORDINARY MEMBERS OF COUNCIL :

GEORGE BARGER, M.A., D.Sc.

EDWARD JOHN BEVAN.

WILLIAM ROBERT BOUSFIELD,
M.A., K.C.

ADRIAN JOHN BROWN, M.Sc., F.R.S.

HAROLD GOVETT COLMAN, D.Sc.,
Ph.D.

FREDERICK GEORGE DONNAN, M.A.,
Ph.D., F.R.S.

ARTHUR HARDEN, D.Sc., Ph.D.,
F.R.S.

THOMAS MARTIN LOWRY, D.Sc.
KENNEDY JOSEPH PREVITÉ ORTON,

M.A., Ph.D.
SIR BOVERTON REDWOOD, Bart.,

D.Sc.

EDWARD JOHN RUSSELL, D.Sc.

EDITOR :

JOHN CANNELL CAIN, D.Sc.

ASSISTANT SECRETARY :

STANLEY ERNEST CARR.

SUB-EDITOR :

ALFRED JOHN GREENAWAY.

LIBRARIAN :

FRANCIS WILLIAM CLIFFORD.

COMMITTEES, 1913-14.

Professor WILLIAM H. PERKIN (President), Dr. A. SCOTT (Treasurer), Dr. S. SMILES and Dr. J. C. PHILIP (Hon. Secretaries), and Professor ARTHUR W. CROSSLEY (Foreign Secretary), are *ex officio* members of each Committee.

FINANCE COMMITTEE.

Messrs. E. G. HOOPER, G. T. MOODY, Sir EDWARD THORPE, Sir WILLIAM A. TILDEN, and the Officers.

HOUSE COMMITTEE.

Messrs. HORACE T. BROWN, W. R. DUNSTAN, R. MESSEL, J. E. REYNOLDS, J. MILLAR THOMSON, Sir EDWARD THORPE, Sir WILLIAM A. TILDEN, and the Officers.

LIBRARY COMMITTEE.

Messrs. B. DYER, W. GOWLAND, A. HARDEN, J. T. HEWITT, C. A. KEANE, A. R. LING, T. M. LOWRY, R. MELDOLA, E. J. MILLS, J. MILLAR THOMSON (Chairman), Sir WILLIAM A. TILDEN, J. A. VOELCKER, the Editor, and the Officers.

PUBLICATION COMMITTEE.

Messrs. H. B. BAKER, J. N. COLLIE, F. G. DONNAN, B. DYER, M. O. FORSTER, T. M. LOWRY, A. MCKENZIE, F. B. POWER, and the Officers.

RESEARCH FUND COMMITTEE.

Messrs. H. B. BAKER, W. R. BOUSFIELD, HORACE T. BROWN, J. N. COLLIE, H. B. DIXON, J. J. DOBBIE, M. O. FORSTER, P. F. FRANKLAND, A. LIVERSIDGE, W. J. PORE, and the Officers.

THE ORDINARY SCIENTIFIC MEETINGS for 1913-14 will be held on the following
Thursdays at 8.30 p.m. :—

October 23rd,† 1913	March 5th,* 1914
November 6th, ,,	,, 19th,* ,,
,, 20th,* ,,	April 2nd,* ,,
December 4th, ,,	May 7th, ,,
,, 18th,* ,,	,, 21st,* ,,
January 22nd,* 1914	June 4th, ,,
February 5th, ,,	,, 18th,* ,,
,, 19th,* ,,	

*Council Meetings will be held on these days.

†Extra Meeting, Ladenburg Memorial Lecture.

ANNUAL GENERAL MEETING, THURSDAY, MARCH 26TH, 1914, AT 4.30 P.M.

Society's Bankers :

MESSRS. COUTTS & CO., 440, STRAND, W.C.

Telephone No. : MAYFAIR 1368.

PAST-PRESIDENTS.

THOMAS GRAHAM, M.A., D.C.L., F.R.S. (<i>d.</i> 1869)	{ 1841-1843 1845-1847
ARTHUR AIKIN (<i>d.</i> 1854)... ..	1843-1845
WILLIAM THOMAS BRANDE, F.R.S. (<i>d.</i> 1866)	1847-1849
RICHARD PHILLIPS, F.R.S. (<i>d.</i> 1851)	1849-1851
CHARLES GILES BRIDLE DAUBENY, M.D., F.R.S. (<i>d.</i> 1867)	1851-1853
PHILIP JAMES YORKE, F.R.S. (<i>d.</i> 1874)	1853-1855
WILLIAM ALLEN MILLER, M.D., D.C.L., F.R.S. (<i>d.</i> 1870)	{ 1855-1857 1865-1867
LORD PLAYFAIR, F.R.S. (<i>d.</i> 1898)	1857-1859
SIR BENJAMIN COLLINS BRODIE, BART., D.C.L., F.R.S. (<i>d.</i> 1880)	1859-1861
AUGUST WILHELM VON HOFMANN, PH.D., LL.D., F.R.S. (<i>d.</i> 1892)	1861-1863
ALEXANDER WILLIAM WILLIAMSON, PH.D., F.R.S. (<i>d.</i> 1904)	{ 1863-1865 1869-1871
WARREN DE LA RUE, M.A., D.C.L., F.R.S. (<i>d.</i> 1889)	{ 1867-1869 1879-1880
SIR EDWARD FRANKLAND, K.C.B., D.C.L., F.R.S. (<i>d.</i> 1899)	1871-1873
WILLIAM ODLING, M.A., M.B., F.R.S.	1873-1875
SIR FREDERICK AUGUSTUS ABEL, BART., K.C.B., G.C.V.O., F.R.S. (<i>d.</i> 1902)	1875-1877
JOHN HALL GLADSTONE, PH.D., F.R.S. (<i>d.</i> 1902)... ..	1877-1879
THE RT. HON. SIR HENRY ENFIELD ROSCOE, D.C.L., LL.D., F.R.S.	1880-1882
SIR JOSEPH HENRY GILBERT, PH.D., F.R.S. (<i>d.</i> 1901)	1882-1883
SIR WILLIAM HENRY PERKIN, LL.D., F.R.S. (<i>d.</i> 1907)	1883-1885
HUGO MÜLLER, PH.D., LL.D., F.R.S.... ..	1885-1887
SIR WILLIAM CROOKES, O.M., D.Sc., F.R.S.	1887-1889
WILLIAM JAMES RUSSELL, PH.D., F.R.S. (<i>d.</i> 1909)	1889-1891
ALEXANDER CRUM BROWN, M.D., D.Sc., F.R.S.	1891-1893
HENRY EDWARD ARMSTRONG, PH.D., LL.D., F.R.S.	1893-1895
AUGUSTUS GEORGE VERNON HARCOURT, M.A., D.Sc., F.R.S.	1895-1897
SIR JAMES DEWAR, D.Sc., LL.D., F.R.S.	1897-1899
SIR EDWARD THORPE, C.B., D.Sc., F.R.S.	1899-1901
JAMES EMERSON REYNOLDS, Sc.D., M.D., F.R.S.	1901-1903
SIR WILLIAM AUGUSTUS TILDEN, D.Sc., F.R.S.... ..	1903-1905
RAPHAEL MELDOLA, D.Sc., LL.D., F.R.S.	1905-1907
SIR WILLIAM RAMSAY, K.C.B., D.Sc., F.R.S.	1907-1909
HAROLD BAILY DIXON, M.A., PH.D., F.R.S.	1909-1911
PERCY FARADAY FRANKLAND, PH.D., LL.D., F.R.S.	1911-1913

THE CHEMICAL SOCIETY.

THE Chemical Society was founded on February 23rd, 1841, and its first General Meeting was held on March 30th of that year. In 1848 a Charter of Incorporation was granted to the Society by the Crown, under the conditions of which it consists of Fellows, Honorary and Foreign Members, and Associates.* The Fellows elect out of their own body a Council consisting of a President, Vice-Presidents, a Treasurer, two Secretaries, a Foreign Secretary, and twelve other Fellows, by whom the business of the Society is conducted.

The object of the Society, as laid down in the Charter, is the general advancement of Chemical Science, by the discussion and publication of new discoveries, and the interchange of valuable information respecting them.

A Candidate for election as a Fellow of the Chemical Society must send to the Secretaries a Certificate subscribed by not less than five Fellows of the Society, to three at least of whom he must be personally known.† The Certificate will be read at three Ordinary Scientific Meetings of the Society, and the Candidate will afterwards be balloted for. When elected, he will receive notice thereof from the Secretaries.

Each Fellow has the right to be present and to vote at all Meetings of the Society, and to propose Candidates for admission into the Society, and is entitled to one copy of the Annual Publications so long as his Annual Subscription be not in arrear. He is also entitled to the use of the books in the Society's Library, under such restrictions as the Council may deem necessary. He has the privilege of introducing to Ordinary Scientific Meetings of the Society, two visitors, whose names are entered in a book kept for that purpose, together with the name of the Fellow introducing such visitors.

When elected, every Candidate previous to admission is required, within three months from the date of his election, to pay an admission fee of £4, and either his first annual subscription, or his life composition fee; otherwise his election becomes void. The annual subscription to be paid by Fellows is £2. The subscriptions of Fellows become due on the first day of January of every year. The life composition fee is £30, excepting that Fellows who have paid ten annual subscriptions pay as life composition fee £20; Fellows who have paid fifteen annual subscriptions pay £15; Fellows who have paid twenty annual subscriptions pay £12; and Fellows who have paid twenty-five annual subscriptions pay £10.

If a Candidate be elected during the month of November or December, he will not be called upon to pay any annual subscription for

* No elections of Associates have taken place for many years.

† In the case of Candidates resident abroad unable to obtain this number of signatures, the Council have power to accept a certificate signed from personal knowledge by one Fellow of the Society, and to recommend its presentation for ballot.

the current year, and will not be entitled to receive the publications of the Society for that year.

Any Fellow who at the period of the Annual General Meeting of the Society in March owes two annual subscriptions, such subscriptions having been duly applied for, and no reason satisfactory to the President and Council having been assigned for their non-payment, shall cease to be a Fellow of the Society, and his name will be removed from the Society's List accordingly: Provided, nevertheless, that on a solicitation for re-admission being addressed to the President and Council by a person so circumstanced, the case of such person will be considered by the Council, who may, if they see fit, reinstate him as a Fellow of the Society, upon his paying the arrears of his subscription, or a life composition fee.

COMMUNICATION OF PAPERS.

The attention of Authors is directed to the following resolutions of Council regarding Scientific Communications submitted to the Chemical Society:

1. All Scientific Communications for the Transactions and Proceedings should be addressed to "The Secretaries, Chemical Society, Burlington House, W."

2. No title can be included in the list of Scientific Communications to be brought before any Ordinary Scientific Meeting of the Society unless the paper, or an abstract thereof, is received by the Secretaries on the Monday previous to the day of Meeting. The titles of Scientific Communications cannot be announced in the Proceedings unless such Communications, or the abstracts thereof, are received by the Secretaries at least ten days before the Meeting.

3. In the case of every Communication submitted for the Transactions, an Abstract of not more than three hundred words must be supplied for insertion in the Proceedings.

4. Papers which are deemed by the Council unsuitable for publication in the Society's Transactions or Proceedings shall be deposited in the Society's Archives. Authors are therefore advised to retain copies of their papers.

5. All papers communicated to the Society, with their illustrative drawings, shall become the property of the Society, unless stipulation be made to the contrary, and Authors shall not be at liberty, save by permission of the Council, to publish elsewhere the papers they have communicated until such papers, or abstracts of them, have appeared either in the Transactions or Proceedings of the Society, respectively, or have been returned to the Author, or withdrawn from publication by the Author. Communications which have appeared in any other Journal shall not be published in the Society's Transactions or Proceedings unless this course is approved by a special vote of the Council.

6. The address to which proofs are to be sent should be written on every paper and abstract.

7. If Authors require more than the 50 reprints allowed by the Society, they should inform the Editor at the time they send in their corrected proofs, when the extra copies will be supplied at rates which can be obtained from the Printers.

8. Illustrations for the Journal and Proceedings (including curves) are, as far as possible, executed in photographic "process" work, and, accordingly, drawings, etc., accompanying the papers must be carefully drawn, about twice the size of the finished block, on smooth, white Bristol board in Indian ink, so as to admit of the blocks being prepared directly from the drawings. Any lettering on these drawings should be of such a size that it will be clearly legible when reduced. When it is necessary to use plates, these must be also of convenient dimensions.

PUBLICATIONS OF THE SOCIETY.

With the exception of certain numbers of the Journals and Proceedings which are out of print, the following publications may be obtained from Messrs. Gurney and Jackson, 33, Paternoster Row, E.C. :

		Price to Fellows.			Price to Public.		
		£	s.	d.	£	s.	d.
Memoirs and Proceedings, 1841-1847 (3 Vols.)	... per vol.	1	0	0	1	10	0
Quarterly Journal, 1848-1862 (14 Vols.)	... per vol.	1	0	0	1	10	0
" " " (Single Parts)	... per part		5	0		7	6
Journal, 1862-1895	... per ann.	1	10	0	1	10	0
" " " (Single Parts)	... per part		2	6		2	6
" 1896 to present date	... per ann.	2	0	0	2	0	0
" " " (Single Parts)	... per part		3	6		3	6
Proceedings, 1885 to present date	... per vol.	7	6		7	6	
" " " (Single Parts)	... per part		6			6	
Annual Reports on the Progress of Chemistry (bound in cloth),							
Vol. I (1904) to present date	... per vol.	4	6		4	6	
Collective Index, Vol. I. 1841-1872	... per vol.	4	0		4	0	
* " " " II. 1873-1882	... per vol.	10	0		15	0	
* " " " III. 1883-1892	... per vol.	15	0		1	0	0
* " " " IV. 1893-1902	... per vol.	1	0	0	1	10	0
† " " " V. 1903-1912	... per vol.*	2	0	0	2	10	0
† Jubilee Volume, 1891...	... per vol.		6	0		6	0
† Memorial Lectures, 1893-1900	... per vol.		7	6		7	6
† Library Catalogue, 1886	... per vol.		1	0		1	0
† " " 1903	... per vol.		2	6		2	6
† Cases for binding the Journal in 4 vols.	... per year		4	0		4	0
Tables of International Atomic Weights for 1913 (as recommended by the International Atomic Weights Committee) :							
ON CARDS : 1s. per dozen ; 4s. for 50 ; 7s. 6d. per 100.							
Postage extra.							
ON PAPER : 4d. per dozen ; 1s. for 50 ; 1s. 9d. per 100.							
Postage extra. (<i>Suitable for pasting into Note Books.</i>)							

* Postage to Fellows One Shilling extra.

† Post free to Fellows.

* Part I. Author's Index, now ready.

The *Journal*, which is published on the last day of each month, includes the Transactions of the Chemical Society and Abstracts of chemical papers published in other Journals.

The *Proceedings* contain certain papers read at the Meetings and abstracts of the remainder and of the discussions. They are, as a rule, issued to the Fellows about a week after each Ordinary Scientific Meeting.

The Annual Reports on the Progress of Chemistry contain an epitome of the principal definite steps in advance which have been made during the year. Fellows can obtain, from the Assistant Secretary, cases for binding the Annual Reports, price One Shilling each.

RESEARCH FUND.

The Research Fund of the Chemical Society has been established for the purpose of assisting investigators by defraying the cost of expensive materials. The income accruing from the munificent donations received from the Goldsmiths' Company and from the Perkin Memorial Fund will be devoted as far as possible to the encouragement of research in (a) metallurgical and inorganic chemistry and (b) the chemistry of coal-tar products, respectively.

The Committee meets twice a year to consider applications for grants; and forms of application, which can be obtained from the Assistant Secretary, must be lodged with the Secretaries by the end of May and November in each year.

LIBRARY RULES.

1. The Library is open for reference, and for the issue and return of books, daily from 10 a.m. to 6 p.m. (Saturdays 10 a.m. to 2 p.m.); and in the evenings of those days on which the Chemical Society meets.

2. Fellows are not allowed to have on loan more than *six* volumes at a time, without special permission from the Librarian.

3. All Journals, Dictionaries, and Pamphlets of which there are not duplicate copies, and certain early Chemical and other Books distinguished in the Library Catalogue by a star, belong to the Reference Library, and are not for general circulation. Fellows desiring to borrow books from the Reference Library must make a special application in writing to the Librarian, undertaking to bear all risks of transit, &c., and to return the volumes within one month; the Librarian may then, at his discretion, issue such books. This regulation does not apply, however, to volumes of Periodicals of which no duplicate copies exist in the Library.

4. A book may not be taken out of the Library until one month after it has been received.

5. Books must not be removed from the Library until a voucher for them has been signed and delivered to the Librarian.

6. Books are issued either to the Fellow desiring the loan, or to a person bringing a written order from him. In either case a receipt must be given on the form provided. When a Fellow desires a book or books to be sent to him, he must send to the Librarian a written order, and pay the whole cost of carriage. All books borrowed by Fellows shall be at the risk of the borrower from the moment they are issued or despatched by the Librarian, and until they are returned to him.

7. Books may not be sent out of the United Kingdom.

8. Books which have been bespoken shall circulate in the order of application.

9. Fellows shall be at liberty to retain a book one calendar month, unless, at the expiration of a fortnight, notice is received that the book is required by another Fellow, in which case it must be returned at once. Single parts of journals may not be retained longer than one week.

10. The names of Fellows borrowing books shall be entered by the Librarian, or Officer in attendance, in a book kept for that purpose. When a Fellow returns a book, his voucher shall be given to him, and a record of the return duly made.

11. In the case of Fellows returning books by messenger or public conveyance, the voucher shall be returned by the Librarian through the post.

12. Fellows retaining books longer than the time specified, or neglecting to return them when demanded, shall forfeit the right to borrow books from the Library until the volume or volumes be returned.

13. Fellows to whom books have been issued shall be held responsible for their preservation from injury; and if any book when returned is found to have been damaged, the Council may order that it be repaired or replaced at the expense of the borrower. In the event of any book being lost, or being detained after application has been made for its return, the Council may replace, at the cost of the borrower, the volume or volumes so lost or detained. This rule shall also apply to single parts of current periodicals.

14. For the purpose of revision and cleaning, the Library shall be closed for a fortnight in August of each year; before which time all books must be returned, unless special permission has been previously obtained from the Librarian. In the event of any book not being returned on such occasion, the Council may replace it at the cost of the borrower.

15. No persons other than Fellows of the Society have the privilege of using the Library, except upon a written introduction from a Fellow, with whom rests the responsibility for all books consulted by the person introduced. Such introduction shall be valid for one occasion only.

NAMES OF HONORARY AND FOREIGN MEMBERS.

NUMBER NOT TO EXCEED FORTY.

Date of Election.	
Jan. 20, 1898	Arrhenius, Prof. Dr. Svant August, F.R.S., Bergsgaten 18, Stockholm
May 18, 1876	Baeyer, Geh. Rat Prof. Dr. Adolph von, F.R.S., Arcis-str. 1, Munich
March 2, 1911	Bamberger, Prof. Dr. Eugen, Germaniastrasse 51, Zürich IV, Switzerland
March 2, 1911	Cianpician, Prof. Giacomo, Regia Universita, Bologna, Italy
May 18, 1904	Clarke, Prof. Frank Wigglesworth, LL.D. (Aberd.), United States Geological Survey, Washington, D.C., U.S.A.
May 18, 1904	Curie, Madame Marie, La Sorbonne, Paris
Jan. 20, 1898	Curtius, Geh. Rat Prof. Dr. Theodor, Universität, Heidelberg
June 16, 1892	†Fischer, Geh. Rat Prof. Dr. Emil, F.R.S., Hessischestrasse 1, Berlin, N., Germany
Jan. 20, 1898	Franchimont, Prof. Dr. Antoine Paul Nicolas, Rapenburg 104, Leyden
Feb. 6, 1908	Gautier, Prof. Armand Emile Justin, 9, Place-des-Vosges, Paris
June 16, 1892	Graebe, Prof. Dr. Carl, Westendstrasse 28, Frankfurt-am-Main, Germany
March 2, 1911	Groth, Prof. Dr. Paul Heinrich Ritter von, F.R.S., The University, Munich
March 7, 1912	Guye, Prof. Philippe Auguste, D.Sc. (Geneva and Paris), 3, Chemin Bizot, Geneva, Switzerland
Feb. 6, 1908	Haller, Prof. Albin, 10, Rue-Vauquelin, Paris
Feb. 6, 1908	Hittorf, Dr. Johann Wilhelm, Westfälische Wilhelms-Universität, Münster, Westfalen, Prussia
Jan. 20, 1898	Körner, Prof. Guglielmo, R. Scuola Superiore d'Agricoltura, Milan
June 5, 1913	Konovaloff, Geh. Rat. Prof. Dmitri Petrovitsch, Ministergehilfe für Handel und Industrie, St. Petersburg, Russia
Feb. 6, 1908	Le Bel, Joseph Achille, F.R.S., 250, Rue Saint Jacques, Paris
Feb. 6, 1908	Le Chatelier, Prof. Henri Louis, 73, Rue Notre Dame des Champs, Paris
June 16, 1892	Lieben, Hofrat Prof. Dr. Adolph, Mölkerbastei 5, Vienna I., Austria
May 18, 1904	Liebermann, Geh. Rat Prof. Dr. Carl, Matthäikirchstrasse 29, Berlin, W., Germany
March 4, 1909	Lunge, Georg, Prof., Ph.D. (Breslau), Hon. Dr. Ing. (Karlsruhe), Carmenstrasse 37, Zürich, Switzerland
May 18, 1904	Morley, Prof. Edward Williams, Hon. D.Sc. (Yale), West Hartford, Conn., U.S.A.
March 2, 1911	Nernst, Geh. Rat Prof. Dr. Walther, Karlsbad 26A, Berlin W. 35, Germany

† Faraday Lecturer, 1907

Date of Election.

March 7, 1912	Osborne, Dr. Thomas Burr, 52, Trumbull-street, Newhaven, Conn., U.S.A.
Jan. 20, 1898	*Ostwald, Geh. Rat Prof. Wilhelm, LL.D. (Aberd.), Grossbothen, Kgr., Sachsen
Jan. 20, 1898	Remsen, Prof. Ira, Johns Hopkins University, Baltimore, U.S.A.
Feb. 6, 1908	†Richards, Prof. Theodore William, S.B. and Hon. LL.D. (Haverford), A.M., Ph.D. (Harvard and Christiania), Hon. D.Sc. (Harvard, Oxon. and Manc.), Hon. Sc.D. (Yale), Hon. Ph.D. (Prague), Hon. Chem. D. (Clark Univ.), Hon. M.D. (Berlin), Hon. D.Sc. (Cantab.), Harvard University, Cambridge, Mass., U.S.A.
June 16, 1892	Schiff, Prof. Dr. Hugo, Via Gino Capponi 3, Florence, Italy
June 16, 1892	Schlesing, Prof. Dr. Théophile, Institut Agronomique, Paris
Jan. 20, 1898	Waals, Prof. Dr. Johannes Diderik van der, P.C., Hooftstraat 117, Amsterdam
March 7, 1912	Walden, Prof. Paul, Mem. Imp. Russ. Acad. Sc. (St. Petersburg), Ph.D. (Leipzig), M.Chem. (Odessa), D.Chem. (St. Petersburg), The Polytechnik, Riga, Russia
Feb. 6, 1908	Wallach, Geh. Rat Prof. Dr. Otto, Königl. Georg August Universität, Göttingen, Prussia
June 5, 1913	Werner, Prof. Alfred, Freie-strasse 111, Zürich, Switzerland
March 7, 1912	Willstätter, Prof. Dr. Richard, Faradayweg 10, Berlin-Dahlem, Germany

* Faraday Lecturer, 1904.

† Faraday Lecturer, 1911.

FARADAY LECTURERS.

- 1869. Jean Baptiste André Dumas.
- 1872. Stanislas Cannizzaro.
- 1875. August Wilhelm von Hofmann.
- 1879. Charles Adolphe Wurtz.
- 1881. Hermann Ludwig Ferdinand von Helmholtz.
- 1889. Dmitri Ivanovitch Mendeléeff.
- 1895. John William Strutt, Lord Rayleigh.
- 1904. Wilhelm Ostwald.
- 1907. Emil Fischer.
- 1911. Theodore William Richards.

LONGSTAFF MEDALLISTS.

- 1881. Thomas Edward Thorpe
- 1884. Cornelius O'Sullivan.
- 1888. William Henry Perkin
- 1891. Francis Robert Japp.
- 1894. Horace Tabberer Brown.
- 1897. William Ramsay.
- 1900. William Henry Perkin, jun.
- 1903. William Jackson Pope.
- 1906. Walter Noel Hartley.
- 1909. Frederic Stanley Kipping.
- 1912. Herbert Brereton Baker,

Date of
Election.

1909	Trans.	Adlam, George Henry Joseph, B.A. and B.Sc. (Oxon.), City of London School, Victoria Embankment, E.C.
1885		Adrianse, John Sabine, Ph.D., Williams College, Williamstown, Mass, U.S.A.
1906		Agar, Shelton Gottlieb, La Fontaine, Clifton, Guernsey, Channel Islands
1909		Aiyer, Yegna Narayan, M.A. (Cantab. and Madras), Department of Agriculture, Bangalore, India
1908		Akers, Noel Charles, F.I.C., 26, King's-avenue, Muswell Hill, N.
1879		Albright, George Stacey, M.A. (Cantab.), Bromesberrow-place, Ladbury
1893		Albuquerque, John Pedrozo d', Prof., M.A. (Cantab.), F.I.C., Government Laboratory, Barbados, West Indies
1892		Alcock, John While, 25, Warwick-road, Sparkhill, Birmingham
1902		Alder, John Frederick, Manor Side, Church-end, Finchley, N.
1903		Alderton, Gilbert John, B.Sc. (Lond.), F.I.C., 46, Westmount-road, Eltham Park, Kent
1911		Allan, James, M.A. (Glas.), B.Sc. (Lond.), School House, Cowdenbeath, Fife
1886		Allan, James Henry, L.R.C.P. and L.R.C.S. (Edin.), Rosslyn, St. Domingo-grove, Everton, Liverpool
1896		Allan, John, 77, Northern-grove, West Didsbury, near Manchester
1907		Allan, John Campbell, 91, Norse-road, Scotstoun, Glasgow
1912		Allcock, Thomas, Glan Usk, The-avenue, Marton, Yorkshire
1907		Allen, Alfred Frederick, B.Sc. (Lond.) 35, Purrett-road, Plumstead, S.E.
1894		Allen, Frederick John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1901		Allen, Frederick Thomas, B.Sc. (Dun.), The Grammar School, Ramsey, Huntingdon
1870		Allen, John, Phœnix Chemical Works, Upper North-street, Poplar, E.
1904		Allen, William Harold Richard, c/o Straits Trading Co., Butterworth, Penang, Straits Settlements
1894		Allibon, George Henry, Mayfield, Lisburn-road, Balmoral, Belfast
1905		Allison, James Albert, Luchana Laboratory, Apartado 45, Bilbao, Spain
1908	Trans.	Allmand, Arthur John, D.Sc. (L'pool), Chemical Laboratories, University College, Gower-street, W.C.
1899		Allworthy, James Herbert, B.Sc. (Lond.), Northaldin, Lower Addiscombe-road, Addiscombe, Croydon
1899		|| Allworthy, Samuel William, M.A., M.D., B.Ch., L.M., and D.P.H. (Dub.), The Manor House, Antrim-road, Belfast

Date of Election.		
1903		Alton, William Lester St. John, F.I.C., The Radium Institute, 16, Riding House-street, Portland-place, W.
1912		Amies, Edwin John, B.Sc. (Lond.), A.R.C.S., 10, Salisbury-road, Thorpe Hamlet, Norwich
1885	Proc.	|| Amphlett, Edward Greenhill, M.A. (Oxon.), 3, Union-place, Worthing
1911		Anderson, Edward, Hill View House, Waun Wen-road, Swansea
1890		Anderson, Frederic Alfred, B.Sc. (Lond.), F.I.C., 24, Grainger-street-west, Newcastle-on-Tyne
1895		Anderson, Herbert, The Blue School, Wells
1899		Anderson, James William, Madras Cement Works, Royapuram, Madras, India
1901	Trans.	Anderson, William Carrick, M.A., D.Sc. (Glas.), 7, Scott-street, Garnethill, Glasgow
1892		|| Anderson, William Smellie, Christmas Island, Straits Settlements
1908		Andraee, Edward Philip, Ph.D. (Berlin), c/o The British Glanzstoff Manufacturing Co., Ltd., Flint
1905	Trans.	Andrews, Albert Edward, St. Hilda, 20, Carew-road, Thornton Heath, Surrey
1888		Andrews, Edward Arthur, St. Mary's Hospital, Paddington, W.
1882		|| Andrews, Launcelot Winchester, Ph.D. (Göttingen), 1719, Rock Island-street, Davenport, Iowa, U.S.A.
1905	Trans.	Angel, Andrea, M.A. and B.Sc. (Oxon.), 15, Banbury-road, Oxford
1877		Angell, John, F.I.C., 6, Beacon's-field, Derby-road, Withington, Manchester
1909		Anklesaria, Jehangir Dhanjishaw, Ahmedabad, India
1909		Annett, Harold Edward, B.Sc. (Lond.), Agricultural College, Lyallpur, Punjab, India
1905		Anthony, Charles, jun., M.Inst. C.E., Casilla de Correo, 149, Bahia Blanca, Argentine, S. America
1910	Trans.	Applebey, Malcolm Percival, M.A. and B.Sc. (Oxon.), Jesus College, Oxford
1879		|| Appleby, Herbert, 2, John Dalton-street, Manchester
1903		Appleyard, George Henry, F.I.C., Arnold House, Burton-road, Hornsea, Hull
1890	Trans.	Appleyard, James Robert, Royal Technical Institute, Salford
1903		|| Appleyard, Percy, Albany, Western Australia
1884		Archbutt, Leonard, F.I.C., The Yews, Madeley-street, Derby
1912		Arkell, Daniel, B.Sc. (Lond.), 259, Monument-road, Edgbaston, Birmingham
1875		Armistead, William, M.B. and C.M. (Edin.), Stapleford, Cambridge
1903	Trans.	|| Armstrong, Edward Frankland, D.Sc. (Lond.), Ph.D. (Berlin), F.C.G.I., 27, Eastern-avenue, Reading

Date of
Election.

1899			Armstrong, Frederick William, 1, Palewell-park, East Sheen, S.W.
1870	Trans.	{C.1873-5 S. 1875- 93 P.1893-5}	|| Armstrong, Henry Edward, Prof., LL.D. (St. Andrews), Ph.D. (Lips.), F.R.S., 55, Granville-park, Lewisham, S.E.; and Central Technical College, Exhibition-road, S.W.
1909			Armstrong, James Alexander Haddon, c/o Messrs. Romer Robinson & Co., Field-street-buildings, Durban, Natal, S. Africa.
1905			Arnaud, Francis William Frederick, F.I.C., Chemical Laboratory 16, Arundel-street, Portsmouth
1909			Arnfield, Harold, Peak Lodge, Buxton-road, Stockport
1906	Trans.		Arup, Paul Seidelin, M.A. (Nova Scotia), B.Sc. (Lond.), 24, Osterley-park-road, Southall
1903			Ashdown, Herbert Henry, 88, Southgrove-road, Sheffield
1911			Ashe, Albert, 55, Warrior-square, Southend-on-Sea
1901			Aspinall, Thomas, 34, Chorley New-road, Bolton
1900	Trans.		Aston, Bernard Cracroft, F.I.C., 71, Devon-street, Wellington, New Zealand
1901	Trans.		Aston, William George, The Square, Valentines-park, Ilford, E.
1911			Atkins, Ernest Andrew, 71, East-hill, Wandsworth, S.W.
1903			Atkinson, Edwin Bayles, Furze Glen, Lambert-road, Grimsby
1903			Atkinson, Harford Montgomery, B.Sc. (Wales), Ph.D. (Göttingen), Municipal Technical Institute, Limerick, Ireland
1911			Atkinson, Norman Ernest, 100, Ellesmere-road, Stockton Heath, Warrington
1872	Trans.		|| Atkinson, Robert William, B.Sc. (Lond.), F.I.C., 44, Stuart-street, Cardiff
1903	Trans.		Attwell, Herbert Moore, A.R.C.S., St. Margaret's-hill, Bradford-on-Avon
1908			Aubertin, Thomas, B.A. (Oxon.), Aboukir Lodge, Carnoustie, Forfarshire
1903			Aubrey, Henry James, The Cross, Worcester
1910			Auchinleck, Gilbert Grahame, B.Sc. (McGill), Agricultural Dept. Grenada, British West Indies
1895	Trans.		|| Auden, Harold Allden, 13, Broughton-drive, Grassendale, Liverpool
1886			|| Andley, James Aloysius, B.Sc. (Lond.), A.R.C.S., F.I.C., 17, Gladstone-place, Hanley
1911	Trans.		Auld, Samuel James Manson, D.Sc. (Lond.), Ph.D. (Würzburg), F.I.C., Brackenhurst, Wokingham-road, and University College, Reading
1906	Trans.		|| Austin, Percy Corlett, M.A. (Cantab.), Westminster Training College, 130, Horseferry-road, Westminster, S.W.
1892			Avery, David, M.Sc. (Melbourne), 461, Barkers-road, Kew, Melbourne, Australia

Date of Election.		
1896		Aykroyd, Henry Edward, Woodbank, Harden, Bingley
1908		Ba, Maung, B.A. (Calcutta), Rangoon College, Rangoon, Burma
1912	Trans.	|| Baeker, Hilmar Johannes, D.Chem. (Leyden), 1, Hugo de Groot-straat, Leyden, Holland
1903		|| Badcock, William Cornish, M.A. (Cantab.), Northampton and County School, Northampton
1907	Trans.	Bagley, George, c/o Young's Chemical Works, 14, Egmont-street, Wellington, New Zealand
1912	Trans.	Bailey, Clement William, M.Sc. (Birm.), Schönleinstrasse 11, Zürich, Switzerland
1907		Bailey, Francis James, Findon Hill, Sacriston, Durham
1875	Trans.	|| Bailey, George Herbert, Ph.D. (Heidelberg). D.Sc. (Lond.), The University, Manchester; and Edenmor, Kinlochleven, Argyll
1893		Bailey, Henry, 39, Ingleby-road, Ilford
1912		Bailey, William Llewelyn, Central Buildings, Matlock Bank, Matlock
1900	Trans.	Bain, Alexander William, B.A. and B.Sc. (Lond.), F.I.C., Fairlight, Muswell-rise, Muswell Hill, N.
1884		|| Bain, Daniel, United Alkali Co., Ltd., Allhusen's Works, Gateshead-on-Tyne
1891		Bairstow, John, Burley, Queen's-park, Chester
1901		Baker, Arthur, 2, Carlton-avenue, Horn's Cross, Greenhithe, Kent
1889		|| Baker, Charles Frederic, B.Sc. (Lond.), Ph.D. (Strassburg), Technical College, and 29, Roker-park-road, Sunderland
1883	Trans.	|| Baker, Charles John, The Schools, Shrewsbury
1899		Baker, Clement Harrison, c/o Messrs. C. Harrold & Co., 2 and 3, St. Paul's-square, Birmingham
1907	Trans.	Baker, Frank, B.Sc. (Lond.), A.I.C., c/o Nobel's Explosives Co., Ltd., Stevenston, Ayrshire
1902		Baker, Frederick Guy Stirling, M.A. (Oxon.), F.I.C., Marryatt's Lodge, Snaresbrook, Essex
1881	Trans.	Baker, Harry, F.I.C., Epworth House, Moughland-lane, Runcorn
1884	Trans.	† || Baker, Herbert Brereton, Prof., M.A. and D.Sc. (Oxon.), F.R.S., Imperial College of Science and Technology, S. Kensington S.W. ; and Latchmoor House, Gerrard's Cross, Bucks.
1912		Baker, James Henry Young, 86, Chestnut-avenue, Hamilton, Ontario, Canada
1893	Trans.	C. 1908-11 Baker, Julian Levett, F.I.C., Stainesbury Holt, Kingston-road, Staines
1908	Proc.	Baker, Thomas James, D.Sc. (Lond.), B.Sc. (Birm.), St. Margaret's Lodge, Chester-road, Erdington, Birmingham

† Longstaff Medallist, 1912.

Date of
Election

1873			Baldock, John Henry, Overdale, St. Leonard's-road, Croydon
1901	Trans.		Ball, Walter Craven, M.A. (Oxon.), Sc.D. (Dub.), F.I.C., Warren Cottage, Hayes, Kent
1892			||Ballantyne, Horatio, F.I.C., 75, Chancery-lane, W.C.
1908			Ballantyne, William Henry, B.Sc. (Glas.), 17, Westwell-road, Streatham Common, S.W.
1896			Ballingall, William, M.A. (St. Andrews), 9, Dndhope-terrace, Dundee
1891	Trans.	C. 1905-08	Baly, Edward Charles Cyril, Prof., F.R.S., F.I.C., The University, and 14, Sunnyside, Prince's-park, Liverpool
1886			Bamber, Henry Kelway George, Ingress House, Greenhithe, Kent
1890	Proc.		Bamber, Montague Kelway, F.I.C., The Laboratory, Hyde-park-corner, Colombo, Ceylon
1896			Banerjee, Gopal Chandra, Kaiser Soap Co., Cawnpore, India
1910	Proc.		Banerjee, Manindra Nath, Prof., 3, Padmanath-lane, Shambazar, Calcutta, India
1907			Banks, Arthur John, c/o The Ogilvie Flour Mills Co., Ltd., Montreal, Canada
1911			Barbary, John Ewart Trounce, Vellansaundry, Camborne
1904	Trans.		Barbour, William, M.A. and B.Sc. (St. Andrews), F.I.C., Glenside, Sorbin-road, Saltecoats, B.O., Ayrshire
1905			Barbrook, George Henry, c/o Messrs. T. Prentice & Co., Stow-market, Suffolk
1880			||Barclay, Arthur Edward, 95, Farringdon-street, E.C.
1903	Trans.	C. 1913-	||Barger, George, Prof., M.A. (Cantab.), D.Sc. (Lond.), The Royal Holloway College, Egham, Surrey
1906			Barker, Arthur Ernest, B.A. and B.Sc. (Lond.), Edenhurst, Gloucester-road, Ross, Herefordshire
1909			Barker, Donald William Elsom, c/o Messrs. E. M. & M. T. Chater, 129, High-street, Watford
1890			||Barker, Joseph, Rev., M.A. and D.D. (Oxon.), Newton House, Newton, near Nottingham
1903	Trans.		Barker, Thomas Vipond, M.A. and B.Sc. (Oxon.), Mineralogical Dept., University Museum, Oxford
1896			Barker, William Henry, B.Sc. (Lond.), Addiscombe, Empress-avenue, Wanstead Park, Essex
1894			Barlet, Stéphane, B. ès Sc. (Gall.), 97, St. Mark's-road, North Kensington, W.
1897			Barlów, Herbert William Loyland, M.A. and M.D. (Oxon.), M.R.C.S. and L.R.C.P. (Lond.), D.P.H., (Cantab.), Holly Bank, Croftsbank-road, Urmston, Manchester
1897	Trans.		Barlow, William, F.R.S., The Red House, Stannore, Middlesex
1905			Barnes, James Hector, Prof., B.Sc. (Birm.), F.I.C., Government College of Agriculture, Lyallpur, Punjab, India

Date of Election.			
1875		|| Barnes, Richard Leburn, Phoenix Chemical Works, Hackney Wick, N.E.	
1907	Trans.	Barnett, Edward de Barry, B.Sc. (Lond.), A.I.C., 9, Collingham-road, South Kensington, S.W.	
1912	Trans.	Barnett, Raymond Theodore Fred, B.Sc. (Lond.), A.R.C.S., The Herbert Strutt School, Belper, Derby	
1909	Trans.	Baron, Harold, B.Sc. (Vict.), c/o The British Thomson Houston Co., Ltd., 83, Cannon-street, E.C.	
1908		Barr, Guy, B.A. (Cantab.), B.Sc. (Lond.), The National Physical Laboratory, Teddington, Middlesex	
1888		|| Barraclough, William Herbert, F.I.C., Mortomley, near Sheffield	
1891		Barratt, John Treeby, 21, Godolphin-road, Helston	
1869		Barret, Edward Louis, B.Sc. (Lond.), F.I.C., 12, Avenue de la Grande Armée, Paris	
1906	Trans.	Barrett, Ernest, B.Sc. (Lond.), 27, Merchiston-road, Catford, S.E.	
1908		Barrett, Maurice, Cliff Lawn, Hyde-park, Leeds	
1901		Barrie, Thomas Stewart, M.B., and Ch.B. (Glas.), 23, Granville-street-west, Charing-cross, Glasgow	
1912	Trans.	Barrow, Fred, M.Sc. (Birm.), Ph.D. (Strassburg), Birkbeck College, Breams Buildings, Chancery-lane, E.C.	
1905		Barrowcliff, Marmaduke, F.I.C., The Institute of Medical Research, Kuala Lumpur, Federated Malay States	
1912		Barton, Arthur Leslie, 80, Hotham-road, Putney Common, S.W.	
1872		|| Barton, Robert, Royal Mint, Melbourne, Australia	
1908		Barton, Robert, jun., 1, Fairfield-avenue, Fairfield, Droylsden, Manchester	
1910		Barwick, Fred Wilkinson, Chamber of Commerce Testing House, Royal Exchange, Manchester	
1898		Baskerville, Charles, B.Sc. (Virginia), Ph.D. (N. Carolina), College of the City of New York, New York City, U.S.A.	
1864	Trans.	{ C. 1870- 3, 90-3 }	|| Bassett, Henry, F.I.C., 26, Belitha-villas, Barnsbury, N.
1907	Trans.		Bassett, Henry, jun., Prof., D.Sc. (Lond.), Ph.D. (Munich), D. ès S., (Nancy), F.I.C., University College, Reading
1911			Bate, Joseph, 59, Southwood-lane, Highgate, N.
1891			Bate, William, Upton Villa, Hayle, Cornwall
1913	Trans.		Batey, John Percy, M.Sc. Tech. (Manc.), 3, Minorca-road, Weybridge
1893			Bateman, John, Clovelly, 14, Stirling-road, Clapham Rise, S.W.
1896			Bathurst, Charles, M.A. (Oxon.), M.P., Lydney Park, Glos.
1910			Batley, Ward Allen, M.Sc. (Manc.), 55, Kennedy-road, Weaste, Manchester
1913			Battye, Horace George, 28, Roman-place, Street-lane, Roundhay, Leeds

Date of
Election

1910			Banne, Georges, 44, Quai des Eaux Vives, Geneva, Switzerland
1905			Baxter, John George, Glenarm, Lennox-avenue, Gravesend
1892			Bayliss, Charles, Mino, Hampton-in-Arden, Birmingham
1906			Bayliss, William Heath, Brewery House, Ashwell, Herts.
1874			|| Bayne, James, (unknown)
1879			|| Bayne, William Thirlwall, LL.D. (Cantab.), Brockhill, Broad- clyst, Exeter
1897			Beadle, Alec Alfred, Donnington Dene, Newbury
1891	Trans.		Beadle, Clayton, Oak Bank, Lansdown-road, Sidecup, Kent
1861			|| Beadnell, Charles Edward, Major, R.A., Hafod, Llandinam, Mont.
1903			Beadnell, Charles Marsh, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Fleet Surgeon, H.M.S. Fisguard, Portsmouth
1867			Beale, Sir William Phipson, Bart., K.C., M.P., 2, Whitehall- court, S.W.
1903			Beam, William, M.A. and M.D. (Penn.), F.I.C., Chemical Laboratory, Gordon College, Khartoum, Soudan
1899			Bean, Percy, 10, Marsden-street, Manchester
1913			Beath, William, 152, St. George's-road, Hull
1901			Beaven, Edwin Sloper, Eastway, Warminster
1890	Trans.		Beck, Charles Ridgeway, F.I.C., 53, Norroy-road, Putney, S.W.
1874	Trans.		|| Beckett, George Henry, F.I.C., 35, South Beach-road, Ardrossan
1906			Beckett, Richard Henry, Prof., B.Sc. (Lond.), The Victoria College of Science, Nagpur, C.P., India
1901			Bedford, Frederick, B.Sc. (Lond.), Ph. D. (Halle), 9, Market-place, Sleaford, Lines.
1879	Trans.	C. 1895-09	Bedson, Peter Phillips, Prof., M.A. (Dun.), D.Sc. (Lond. and Dun.), B.Sc. (Vict.), F.I.C., Armstrong College of Science, Newcastle-on-Tyne
1901			Bedwell, John Cardew, B.Sc. (Lond.), 65, High-street, Colchester
1905			Bees, William James, B.Sc. (Lond.), 43, Ash-grove, Hyde-park, Leeds
1899			Beesley, Frederick Arnold, B.Sc. (Lond.), St. Olave's Grammar School, Tower Bridge, S.E.
1872	Trans.	{ C. 1907-11 V.-P. 1911. }	|| Beilby, George Thomas, Hon. LL.D. (Glas.), F.R.S., F.I.C., 11, University-gardens, Glasgow
1891			Belbin, Tom St. John, Capt., Nortonthorpe Hall, near Huddersfield
1891			|| Bell, Albert Edward, F.I.C., 151, Camberwell-grove, S.E.
1886	Trans.		Bell, Chichester Alexander, B.A. and M.B. (Dub.), F.I.C., Torbrex, Headington-hill, Oxford
1889			Bell, Edward Wightman, The Chantry, Spalding
1898			Bell, Hugh Poynter, M.A. (Cantab.), c/o The Bank of Montreal, Toronto, Canada
1907			Bell, John Forbes, Craigmillar, Edinburgh

Date of Election		
1889		|| Bell, Percy Carter, F.I.C., Milburn, New Jersey, U.S.A.
1906		Bell, William Edward, c/o Messrs. Tomlinson and Hayward, Manufacturing Chemists, Lincoln
1904	Trans.	Bellars, Albert Ernest, Prof., M.A. (Cantab.), The Government College, Rangoon, Burma
1905		Belton, Francis George, B.A. (Dun.), 336, Belgrave-road, Birmingham
1879		Bemrose, Joseph, F.I.C., 56, St. Famille-street, Montreal, Canada
1874		|| Bendix, David, F.I.C., Sutherland Lodge, 371, Romford-road, Forest Gate, E.
1902	Proc.	Bengough, Guy Dunstan, M.A. (Cantab.), The University, and 25, Huskisson-street, Liverpool
1902		Benham, Keith Benham, B.Sc. (Lond.), F.I.C., Dean's Hill, Stafford
1881		|| Benjamin, Marcus, A.M. (Lafayette), Ph.B. (Columbia), Ph.D. (Nashville), Sc.D. (Pittsburgh), LL.D. (St. John's Coll., Annapolis), U.S. National Museum, Washington, D.C., U.S.A.
1900	Trans.	Bennett, Alexander Hutcheon, c/o Messrs. G. H. Ogston & Moore, Messina, Sicily
1904		Bennett, Charles Thomas, B.Sc. (Lond.), F.I.C., 102, Queen's-road, Wimbledon, S.W.
1903		Bennett, Colin Noël, Escot, Penzance, Cornwall
1909	Trans.	Bennett, Hugh Garner, M.Sc. (Leeds), 5, St. Nicholas-road, Beverley
1905		Bennett, Joseph, Windsor Printing Co., North Adams, Mass., U.S.A.
1911		Bennison, Ernest Carr, 53, Beaconsfield-road, Cannon-hill, Birmingham
1892	Trans.	|| Bensusan, Arthur John, The Ouro Preto Gold Mines of Brazil, Ltd., Minas de Passagem, Ouro Preto, Brazil
1896	Trans.	Bentley, William Henry, B.Sc. (Vict.), 12, Cromwell-terrace, Irlam, near Manchester
1907		Benton, Frank Stanley, Hursthead, Reigate, Surrey
1890		Bentz, Ernest, 30, Manley-road, Manchester
1910		Berens, Herbert Arthur, 8, Dawson-place, Pembroke-square, W.
1902	Trans.	Bergtheil, Cyril, c/o Messrs. H. S. King & Co., 65, Cornhill, E.C.
1882		|| Beringer, John Jacob, A.R.S.M., F.I.C., 11, Fore-street, Camborne
1895	Trans.	Berkeley, The Rt. Hon. Randal Thomas Mowbray, The Earl of, F.R.S., Foxcombe, Boar's Hill, Oxford
1890		|| Berneastle, Richard, 15, Ladbroke-gardens, Notting Hill Gate, W.
1893		Berridge, Douglas Jesse Penfold, M.A. (Oxon.), The Laboratory, Malvern College

Date of
Election.

1906			|| Berry, Arthur John, M.A. (Cantab.), 14, Regent-street, and Downing College, Cambridge
1882	Trans.		|| Berry, Edward Elhanan, c/o Messrs. Sulman & Picard, 44, London-wall, E.C.; and Vice-Consulate, Bordighera, Italy
1898			Berry, Reginald Arthur, Prof., F.I.C., The West of Scotland Agricultural College, 6, Blythswood-square, Glasgow
1891			Berry, Thomas William, Education Office, Pentre, Rhondda, Glam.
1888	Proc.		Berry, William, 7, Hampton-park, Redland, Bristol
1911			Bescoby, Arthur Cecil, B.A. (Cantab.), 24, Saumarez-street, Guernsey, Channel Isles
1909	Trans.		Best, Stanley Robert, M.Sc. (Manc.), Woodlands, Egerton-road, Chorlton-cum-Hardy, Manchester
1906			Bethea, Oscar Walter, Prof., M.D. (Miss. and Tulane), Ph.G. (Atlanta), 8306, Panola-street, New Orleans, La., U.S.A.
1910			Bethwaite, John, 1, Dalston-road, Workington
1883	Trans.	{ C. 1898- 1900, 1913. }	|| Bevan, Edward John, F.I.C., 3, New-court, Carey-street, W.C.
1886			Bevan, John Williams, F.I.C., c/o Morriston Spelter Works, Morriston, Glam.
1903			Beveridge, Wilfred William Ogilvy, Major, R.A.M.C., D.S.O., M.B. (Edin.), D.P.H. (Cantab.), 53, Burton-court, S.W.
1912			Bews, Charles James Vinall, B.Sc. (Lond.), A.R.C.S., 52, Sir John's-road, Selly Park, Birmingham
1897			Bhaduri, Jyoti Bhushan, M.A. (Calcutta), Krishnaghur College, Krishnaghur, Dist. Nadia, Bengal, India
1903			Bhaduri, Kula Bhushan, Prof., M.A. (Calcutta), Canning College, Lucknow, India
1910			Bhattacharya, Sarat Chandra, Prof., M.A. (Calcutta), Hindu College, Delhi, India
1903			Bibby, Robert Gordon, 5, Halfmoon-street, W.
1865			|| Bickerdike, William Edward, F.I.C., Bryers Croft, Wilpshire near Blackburn
1908			Bickerstaffe, Robert, Chilterns, Wooburn-green, Bucks.
1901			|| Bickford, Harding, 46, Currie-street, Adelaide, South Australia
1875			Biggart, John William, F.I.C., Chemical Laboratory, 29, Cathcart-street, Greenock
1913			Biggart, William Love, Rossarden, Kilmacolm, Renfrewshire
1881			|| Bingley, John, Northampton
1900			Binks, Frederick Nisbet, 5, East-avenue, Benton, Newcastle-on-Tyne
1908			Birch, William Colet, B.A. (Cantab.), F.I.C., Turf Club, Cairo, Egypt
1894			Bird, William Rowland, Chem. Lab., G.W.R. Works, Swindon

Date of
Election.

1912		Birks, Cyril Douglas, Cobnar-gardens, Woodseats, Sheffield
1906		Birt, Roderick Harold Capper, Rev., B.A. (Oxon.), St. Peter's College, Radley, Abingdon
1913		Bissett, Crellyn Colgrave, B.Sc. (Lond.), B.Met. (Sheffield), 10, Claremont-place, Sheffield
1904		Black, John Wyclif, 67, Falcon-road, Edinburgh
1909		Blackburn, Albert Riley, B.Sc. (Lond.), A.R.C.S., The Grammar School, Staveley, Chesterfield
1913		Blackburn, George Frederick William, 25, Rowington-road, Norwich
1911		Blackburn, Joseph Mayson, 346, Deane Church-lane, Bolton
1911		Blackhurst, Arthur Owen, Downing, Broughton, Preston
1899	Trans.	Blackman, Walter Lionel, Mostyn, Stanthorpe-road, Streatham, S.W.
1903		Blackshaw, George Neville, B.Sc. (Wales), Analytical Laboratory, Dept. of Agriculture, Salisbury, Rhodesia, S. Africa
1899		Blackshaw, John Frank, The Cottage, Bromsgrove
1912	Proc.	Blackstock, Gibbs, M.A. (Toronto), Hopefield, Denison-road, Victoria Park, Manchester
1902		Blair, Herbert, 23, Ashley-road, West Harton, South Shields
1901		Blake, George Stanford, 15, Vernon-street, Broughton, Manchester
1890	Trans.	Blake, Robert Frederick, F.I.C., County Analyst's Laboratory, Scottish Provident-buildings, Belfast
1890		Blake, William Henry, 12, Lombard-street, Newcastle-on-Tyne
1875		|| Blanshard, Charles Thomas, M.A. (Oxon.), Lowton, Newton-le-Willows
1906		Blatchley, Charles Frederick Polwhele, B.A. (Oxon.), 13, Templars-avenue, Golders Green, N.W.
1892		Bleckly, Arthur Sanderson, Marldon, Thelwall, Warrington
1902		Blenkinsop, Richard, c/o Messrs. May & Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1890		Blenkinsop, William Edmund Brandford, c/o Messrs. May and Baker, Ltd., Garden Wharf, Church-road, Battersea, S.W.
1909		Bletcher, Henry Ernest John, Prof., College of Pharmacy, Winnipeg, Manitoba, Canada
1903		Bliss, Henry James Wheeler, M.A. (Oxon.), 50, City-road, E.C.
1899		Blofeld, Stuart, Rev., B.A. and B.Sc. (Lond.), Saltley Training College, Birmingham.
1896		|| Blood, Maurice, M.A. (Oxon.), 8, Chichele-road, Cricklewood, N.W.
1891		Bloomer, Frederick John, F.I.C., Penpont, Clydach, Glamorgan
1890	Trans.	Blount, Bertram, F.I.C., 76 and 78, York-street, Westminster, S.W.
1888		Bloxam, Arthur George, F.I.C., 105, Birkbeck Bank-chambers, Southampton-buildings, W.C.

Date of
Election.

1883	Trans.	|| Bloxam, William Popplewell, Prof., B.Sc. (Lond.), F.I.C., 15, Crescent-mansions, Elgin-crescent, Holland Park, W.
1903		Bluman, Nicholas John, 30, Clevedon Mansions, Lissenden-gardens, Highgate-road, N.W.
1887		Blundstone, Edwin Richardson, B.A. (Cantab.), Heathfield, Hampton Hill, Middlesex
1865	Trans.	Blunt, Thomas Porter, M.A. (Oxon.), F.I.C., Tower-place, Shrewsbury
1896		Blyde, Joseph Edwin Alger, East Cliffe, East Bank-road, Sheffield
1875	Trans.	Blyth, Alexander Wynter, M.R.C.S. (Eng.), L.S.A. (Lond.), F.I.C., 26, Avenue-road, Regent's Park, N.W.
1892		Blyth, Meredith Wynter, B.A. (Cantab.), B.Sc. (Lond.), F.I.C., Lacton House, Tanbersley, near Barnsley
1908	Trans.	Blyther, Donald Francis, B.Sc. (Lond.), A.R.C.S., 7, Airthrie-road, Goodmayes, Ilford
1875		|| Boake, Arthur, Chemical Works, Stratford, E.; and High-standing, Loughton, Essex
1902		Boardman, Ernest, B.Sc. (Vict.), 3, Gladc-street, Bolton
1878		Bodmer, Richard, F.I.C., Analytical Laboratory, 16, Southwark-street, S.E.
1898		Bogert, Marston Taylor, Prof., B.A. and Ph.B. (Columbia), Hon. L.L.D. (Clark), Columbia University, New York City, U.S.A.
1906		Bogue, Thomas Going Stoney, 5, Kenilworth-square, Dublin
1869	Trans.	|| Bolas, Thomas, F.I.C., 60, Grove-park-terrace, Chiswick, W.
1901		Bolton, Edward Richards, 46, Stamford Brook-road, Hammer-smith, W.
1899		|| Bond, Alfred Ernest, 13, Hermitage-road, Edgbaston, Birmingham
1883		Bond, Henry Charles, Rev., M.A. (Oxon.), Belle Vue Hall, Brighton
1893	Trans. C. 1909-13	|| Bone, William Arthur, Prof., D.Sc. (Vict.), Ph.D. (Heidelberg), F.R.S., The Imperial College of Science and Technology, S. Kensington, S.W.; and Montrose, Harpenden-road, St. Albans
1912		Bones, Arthur Anderson, 640, Schoeman-street, Pretoria, S. Africa
1893		Boone, William Thomas, B.A. and B.Sc. (Lond.), 6, Sydenham-villas, Cheltenham
1884		Borland, William Dalrymple, F.I.C., Beacon Lodge, Green Street Green, near Dartford, Kent
1881		|| Borns, Henry, Ph.D. (Greifswald), 5, Sutton Court-road, Chiswick, W.
1895		|| Borraillo, Lancelot Alexander, M.A. (Cantab.), Selwyn College, Cambridge
1894	Proc.	Bose, Chuni Lal, Prof., 25, Mohendra Bose's-lane, Calcutta
1881		Bostock, George Henry, 151, Medland-street, West Toronto, Canada

Date of
Election.

1910			Bosworth, Stewart McGregor, B.Sc. (Lond.), 55, Abingdon-road, Kensington, W.
1881	Trans.		Bothamley, Charles Herbert, M.Sc. (Leeds), F.I.C., Tangle Wood, Southside, Weston-super-Mare
1887	Trans.		Bott, William Norman, Ph.D. (Heidelberg), 17, St. Helen's-place, E.C.
1909			Bottomley, Hubert Frederick, c/o Messrs. Sanitas Co., Ltd., Limehouse, E.
1869			|| Bottomley, James Thomson, B.A. (Dub.), M.A. and D.Sc. (R.U.I.), Hon. LL.D. (Glas.), F.R.S., 13, University-gardens, Glasgow
1886			Bottomley, William Beecroft, Prof., M.A. (Cantab.), Ph.D., 35, Downside-crescent, Hampstead, N.W.
1894			Boul, William Good, M.A. and LL.D. (Dub.), D.C.L. (Dun.), Tideswell Grammar School, near Buxton
1910	Trans.		Bourdillon, Robert Benedict, Buddington, Midhurst
1905	Trans.	C. 1911-	Bousfield, William Robert, M.A. (Cantab.), K.C., St. Swithin's, Hendon
1891			Bovell, John Redman, Dodd's Botanical and Experimental Station, Barbados, West Indies
1912	Trans.		Bowack, Douglas Anderson, 89, Fellows-road, Hampstead, N.W.
1912			Bowater, William Henry, School of Mines, Charters Towers, Queensland
1911	Trans.		Bowden, Richard Charles, M.Sc. (Bristol), Royal Gunpowder Factory, Waltham Abbey, Essex
1865			|| Bowdler, Arthur Clegg, F.I.C., 20, Bank-terrace, Wellington-street, Blackburn
1888			Bower, Frank, c/o Messrs. Trnman, Hanbury and Buxton, Spital-fields, E.
1894			Bowes, Harry, F.I.C., Messrs. Bowes and Sims, 40, Radford-street, Blackley, Manchester
1906			Bowis, William John, Ph.D. (Zürich), 25, Rectory-road, West Bridgford, Nottingham
1899			Bowles, Bertram Hennessey, Overdale, Eastwood-road, South Woodford, N.E.
1896			Bowley, Joseph John, Wellington Works, Battersea Bridge, S.W.
1896			|| Bowman, Herbert Lister, Prof., M.A. and D.Sc. (Oxon.), Magdalen College, Oxford
1911			Bowyer, Arthur Stewart, M.Sc. (Manc.), The Woodlands, Chelford, Cheshire
1894	Trans.		Boyd, David Runciman, Prof., D.Sc. (Glas.), Ph.D. (Heidelberg), F.I.C., The Hartley University College, Southampton
1901			Boyers, Henry, 20, Knox's-street, Sligo

Date of
Election.

1910		Bracewell, Geoffrey Alfred, 20, Heaton-grove, Bradford
1910		Bracher, André, 7, Cambridge-mansions, Battersea Park, S. W.
1903		Bradbury, Samuel, Ferneliff, Milton-grove, Glebelands-road, Ashton-on-Mersey, Cheshire
1895		Bradford, Henry, Strettington, near Chichester
1876		|| Bradley, Nathaniel, Sunnyside, College-road, Whalley Range, Manchester
1888		Bradshaw, Charles, 17, Crimicar-lane, Fulwood, Sheffield
1911		Bradshaw, George Arthur, M.Sc. (Manc.), 9, Hyde-park-terrace, Leeds
1910		Brady, Frederick Hugh Rochfort, 39, Brighton-road, Rathgar, Dublin
1910	Trans.	Brady, Oscar Lisle, B. A. (Cape of Good Hope), A.I.C., 51, Upper Bedford-place, W. C.
1906		Braid, Arthur Forbes, c/o The New Jersey Steel Co., Rahway, N. J., U. S. A.
1908		Brakes, William Sudderick, 119, Steade-road, Sheffield
1894	Trans.	Brame, John Samuel Strafford, Royal Naval College, Greenwich, S. E.
1903		Branch, George Thomas, P. O. Box 51, Umtali, Rhodesia, S. Africa
1882		Branson, Frederick Woodward, F. I. C., 14, Commercial-street, Leeds; and Wynneholme, Far Headingley, Leeds
1908		Braun, Marie Joseph Arsène, Ph. D. (Bâle), c/o Fabriques de Produits Chimiques de Thann et de Mulhouse, Thann, Alsace, Germany
1882	Trans.	Brauner, Bohuslav, Prof., Ph. D. (Prague), Hon. D. Sc. (Manc.), New Chemical Laboratory, Bohemian University, Prague VI., Bohemia
1896		Bray, Daniel, 63, Morehampton-road, Donnybrook, Dublin
1909		Breakspear, Henry Shaw, B. A. (Oxon.), The Grammar School, Ludlow
1905		|| Brettell-Vaughan, Edward Shipley Hewitt Edwards, Cwm Cottage, The Cwm, Aston-on-Clun, Salop.
1883		Briant, Lawrence, 24, Holborn-viaduct, E. C.
1901		Bridges, Joseph Samuel, B. Sc. (Lond.), M. A. and LL. D. (Cantab.), Barrister-at-Law, 45, Thistlethwaite-road, Clapton, N. E.
1913		Brier, Albert, M. Sc. (Leeds), B. Sc. (Manc.), 19, Alexander-road, Ulverston
1897		Brierley, James, 33 and 35, French-street, Southampton
1890	Trans.	Brierley, John Thomas, Highfield, Golden Hill, Leyland, near Preston
1898		Brierley, Joseph, B. Sc. (Vict.), 1, Wright-street, Failsworth, Manchester

Date of Election.		
1910		Briggs, John Cockbain, c/o Messrs. R. Walker & Sons, Ltd., Rutland-street, Leicester
1893	Trans.	Briggs, John Frederick, Auchmuty Paper Mills, Markinch, Fife
1906		Briggs, Richard Victor, c/o Dr. C. Schulten, P.O. Box 279, 4, Pollock-street, Calcutta, India
1905	Trans.	Briggs, Samuel Henry Clifford, D.Sc. (Vict.), Greenbank, Cleckheaton, Yorks.
1883		|| Briggs, Thomas Lynton, F.I.C., 188, Central-avenue, Flushing, L.I., U.S.A.
1884		|| Briggs, William, LL.D., D.C.L., M.A., B.Sc., Burlington House, Cambridge
1912		Brindle, Harry, Manchester College of Pharmacy, 225A, Oxford-road, Manchester
1910	Trans.	Briscoe, Henry Vincent Aird, B.Sc. (Lond.), A.R.C.S., 33, Bargery-road, Catford, S.E.
1889		Broadbent, Harry, F.I.C., 9, Bainbridge-road, Leeds
1879		|| Broadbent, John James, F.I.C., Waikino, Ohinemari, Auckland, New Zealand
1883		Brock, John, J.P., F.I.C., Gwern-Tyno, Colwyn Bay, N. Wales
1893		|| Brockbank, John Edwin, The Croft, Kirksanton, viâ Carnforth
1900		Brooke, Charles Berjen, Colne House, Brantham, near Manningtree, Essex
1900		Brooke, John Richard, J.P., F.I.C., Government Opium Factory, Singapore, Straits Settlements
1913		Brooks, Archibald Joseph, Melrose, St. Lucia, British West Indies
1906		Broome, James Spears, M.Sc. (Manc.), 18, Seedley-park-road, Pendleton, Manchester
1886	Trans.	|| Brothers, Horace Edward, B.Sc. (Lond.), F.I.C., 12, St. Mary's-road, Crumpsall, Manchester
1876	Trans.	C. 1910- Brown, Adrian John, Prof., M.Sc. (Birm.), F.R.S., F.I.C., West Heath House, Northfield, Birmingham
1867	Trans.	(C. 1872-4, V. P. 81-4, 90-1, P. 91-3) Brown, Alexander Crum, Prof., M.A., M.D., and F.R.C.P. (Edin.), D.Sc. (Lond.), LL.D. (Aberd. and Glas.), Hon. LL.D. (St. Andrews), F.R.S., F.I.C., 8, Belgrave-crescent, Edinburgh
1870		Brown, David, F.I.C., 93, Abbey-hill, Edinburgh
1891		Brown, Edward Hilton, c/o Messrs. W. Ropes and Co., St. Petersburg, Russia
1873	Trans.	C. 1881-3 || Brown, Frederic Douglas, Prof., B.Sc. (Lond.), University College, Auckland, New Zealand
1884		Brown, Frederic William, Ingleside, 39, Loveday-road, West Ealing, W.

Date of
Election.

1892			Brown, George Fitz-, A.R.S.M., F.I.C., The Broughton Copper Co., Ditton Copper Works, Widnes
1897			Brown, Gerald Noël, 20, Cullum-street, E.C.
1880			Brown, Henry, F.I.C., Benskin's Brewery, Watford, Herts.
1871	Trans.	C. 1883-7, V. P. 1894-7, 1904-7, 1913- T. 1903-04 F.S. 1907- 13	† Brown, Horace Tabberer, LL.D. (Edin.), F.R.S., F.I.C., 52, Nevern-square, Kensington, S.W.
1908			Brown, James, 20, Tower-road, Dartford, Kent
1882			Brown, Reginald Busby, c/o The Badische Co., Ltd., 2, Samuel Ogden-street, Manchester
1908			Brown, Walter, jun., County Offices, Hamilton
1884			Brown, William George, Prof., Ph.D. (N. Carolina), B.S. (Virginia), University of Missouri, Columbia, Missouri, U.S.A.
1896			Browne, Charles Edward, B.Sc. (Lond.), Christ's Hospital, West Horsham, Sussex
1893			Browne, Frank, F.I.C., Government Civil Hospital, Hong Kong, China
1873			Brownen, George, Grove-road-east, Avon-park, Christchurch
1899	Trans.		Browning, Kendall Colin, Prof., M.A. (Cantab.), Medical College, Colombo, Ceylon
1912			Brownlie, David, B.Sc. (Lond.), 41, Corporation-street, Manchester
1890			Brownsword, Frank, M.Sc. (Viet.), F.I.C., Bryn Derwen, Old Colwyn, N. Wales
1902			Bruce, Alexander, B.Sc. (Edin.), The Laboratory, Hyde-park-corner, Colombo, Ceylon
1894	Trans.		Bruce, James, B.Sc. (Lond.), Ph.D. (Munich), A.R.C.S., F.I.C., The Technical College, Huddersfield
1901			|| Bruce-Kingsmill, Julian, Major, R.A., M.A. and B.Sc. (Glas.), Tudor House, Upper Norwood, S.E.
1903			Brühl, Paul, Civil Engineering College, Sibpur, near Calcutta, India
1898	Trans.		|| Brünnich, Johannes Christian, F.I.C., Department of Agriculture, Brisbane, Queensland
1912			Brunjes, Thomas Alfred, 49, St. Donatts-road, New Cross, S.E.
1893	Trans.		|| Brunton, John Dixon, c/o Prof. O. W. Richardson, Princeton, N.J., U.S.A.
1912			Bryant, Ernest Gower, 100, Burlington-street, Manchester
1902			Bryant, Vernon Seymour, M.A. (Cantab.), Trelawne, Crowthorne, Berks.

† Longstaff Medalist, 1894.

Date of Election.		
1877	Trans.	Buchanan, John Young, M.A. (Cantab.), F.R.S., F.I.C., 26, Norfolk-street, Park-lane, W.
1910		Buchner, Eduard, Prof., Ph.D. (Munich), Pleicher Ring 11, Würzburg, Germany
1912		|| Buckle, Edmund Arthur, 29, Etchingham Park-road, Church End, Finchley, N.
1876		|| Buckmaster, Charles Alexander, M.A. (Oxon.), 16, Heathfield-road, Mill Hill Park, Acton, W.
1902		Bucknell, Edwin Thomas Holman, Kingsholme School, Weston-super-Mare
1907	Trans.	Buckney, Frank, B.A. (Cantab.), Custom House, Madras, India
1903		Buggé, Erasmus Robert, Instow, Mycenæ-road, Westcombe Park, S.E.
1911		Bull, Bertram Alfred, English Pharmacy, Government-road, Nairobi, British East Africa
1911		Bull, Joseph Beauchamp, Box 445, Bulawayo, S. Africa
1901		Bult, Herbert John, 18, Billiter-street, E.C.
1912		Bunker, Sidney Waterfield, B.Sc. (Lond.), A.I.C., Government Analysts Department, Singapore, Straits Settlements
1890		|| Bunting, Henry Herbert, Oficina de Ensayes F. C. C. del Peru, Callao, Peru
1896		Burbridge, James Kerry, F.I.C., The Orchard, Philip-lane, Tottenham, N.
1911		Burbridge, Walter Norman, Uplands, Foxley-lane, Purley, Surrey
1891		Burford, Samuel Francis, The Ridgeway, Rothley, Leicester
1909	Proc.	Burger, Oskar Kraftt Heinrich, Prof., Ph.D. (Munich), c/o Messrs. The Farbenfabriken vorm. Friedr. Bayer & Co., Bibliothek, Elberfeld, Germany
1894	Trans.	Burgess, Herbert Edward, Holly House, Graham-road, N.E.
1901		Burgess, Percival James, M.A. (Cantab.), 8, Gunnersbury-avenue, Ealing Common, W.
1884		Burgess, William Thomas, F.I.C., 20, Priory-road, Bedford Park, W.
1903		Burghard, William Godsell, 43, New Oxford-street, W.C.
1884		|| Burland, Jeffrey Hale, Colonel, c/o Fraser Library, Montreal, Canada
1897		Burland, Richard Oxley, J.P., Poolstock House, Wigan
1901		|| Burnett, Theodore Ridley, B.Sc. (Vict.), Ph.D. (Bâle), The George Green Schools, East India Dock-road, Poplar, E.
1893		Burnham, John Charles, B.Sc. (Viet.), F.I.C., Cordite Factory, Aruvankadu, Wellington, Nilgiri Hills, India
1913		Burr, Percy Charles, B.Sc. (Lond.), Essex Lodge, Ravensbourne-park, Catford, S.E.
1882	Trans.	Burrell, Benjamin Arthur, F.I.C., 8, Springfield Mount, Leeds

Date of
Election.

1902	Trans.	Burrows, Harry, Ph.D. (Heidelberg), A.R.C.S., F.I.C., Woodcroft, Southgate, N.
1901	Trans.	Burrows, Merrick William, M.Sc. (Vict.), Dunkirk, Devizes
1905	Trans.	Burt, Bryce Chadleigh, B.Sc. (Lond.), Department of Agriculture, Cawnpore, India
1909	Trans.	Burt, Frank Playfair, D.Sc. (Bristol), B.Sc. (Lond.), 15, Oak-road, Withington, Manchester
1891		Burton, William, Clifton Junction, near Manchester
1912		Bury, Charles Rugeley, B.A. (Oxon.), Ellfield, Wotton-under-Edge, Glos.
1903		Bury, Ernest, M.Sc. (Vict.), Queensmede, Saltburn-by-the-Sea
1909		Bury, Frank Ward, B.Sc. (Manc.), 9, Ynys-street, Port Talbot
1894		Bush, William, School of Science and Art, Free Library, Newport, Mon.
1890		Butcher, William James, B.Sc. (Lond.), Queen Elizabeth Grammar School, Ashbourne, Derbyshire
1895		Butler, David Butler, 41, Old Queen-street, Westminster, S.W.
1890		Butler, William Waters, Southfield, Norfolk-road, Edgbaston, Birmingham
1894		Buttmer, Robert William, St. Mary's, Godalming, Surrey
1875		Butterfield, John Cope, F.I.C., 79, Endlesham-road, Balham, S.W.
1892		Butterfield, William John Atkinson, M.A. (Oxon.), F.I.C., 66, Victoria-street, S.W.
1910	Trans.	Buttle, Bertram Haward, 63, Claremont-road, Forest Gate, E.
1902		Buxy, Tarit Kanti, Prof., Govt. College, Jubbulpore, C.P., India
1888		Byrn, George Alexander, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1906		Byrom, Thomas Henry, F.I.C., The Laboratory, Wigan Coal and Iron Co., Ltd., Wigan
1903		Bywaters, Hubert William, D.Sc. (Lond.), Ph.D. (Würzburg), A.R.C.S., F.I.C., The University, Bristol
1903		Cadman, William Henry, B.Sc. (Wales), Ministry of Education, Cairo, Egypt
1913	Trans.	||Cahen, Edward, A.R.C.S., F.I.C., 32, Queen's-road, Bayswater, W.
1893		||Cahill, Robert Saunderson, Sunnyside, Heckmondwike
1894	Trans.	||Cain, John Cannell, D.Sc. (Viet. and Tübingen), 24, Aylestone-avenue, Brondesbury Park, N.W.
1906		Calam, Harold, M.Sc. (Leeds), B.Sc. (Manc.), F.I.C., 71, Cemetery-road, Beeston-hill, Leeds
1898	Proc.	Caldecott, William Arthur, B.A. (Cape of Good Hope), Box 67, Johannesburg, S. Africa
1891		||Culder, William Alexander Skeen, 449, Hagley-road, Birmingham

Date of Election.		
1907	Trans.	Caldwell, Kenneth Somerville, B.Sc. (Wales), Ph.D. (Leipzig), F.I.C., Bankipore, India
1904	Trans.	Caldwell, Robert John, D.Sc. (Lond.), 105, Wellesley-avenue, Belfast
1906	Trans.	Caldwell, William, M.A. (R.U.I.), Physiological Department, Trinity College, Dublin
1884		Caley, Edward James, Chapel Field Works, Norwich
1907	Trans.	Callan, Thomas, M.Sc. (Manc.), Ph.D. (Heidelberg), c/o The Bridge-of-Weir Leather Co., Bridge-of-Weir, Renfrewshire
1909		Callister, William Edward, B.Sc. (Manc.), 2, Victoria-avenue, Onchan, Douglas, Isle of Man
1903	Trans.	Calvert, Harry Thornton, Ph.D. (Leipzig), M.Sc. (Leeds), B.Sc. (Vict.), F.I.C., West Riding of Yorkshire Rivers Board, Wakefield, Yorks.
1900		Calvert, Sidney, A.M. (Harvard), B.Sc. (McGill Univ.), State University, Columbia, Miss., U.S.A.
1907	Trans.	Cameron, Alexander Thomas, M.A. and B.Sc. (Edin.), Physiological Department, University of Manitoba, Winnipeg, Canada
1910		Camp, Frank Anthony, c/o Messrs. Parry & Co., Madras, India
1912		Campbell, Alfred Varlow, A.C.G.I., Rothamsted Experimental Station, Harpenden, Herts.
1892		Campbell, Andrew, 51, Cluny-drive, Edinburgh
1912	Trans.	Campbell, Arthur Fred, M.Sc. (Manc.), Westwood, Middleton, Manchester
1905		Campbell, Eric William, 10, Cambridge-gardens, Richmond Hill, Surrey
1903		Campbell, Thomas, 52, Eastbourne-street, Liverpool
1898		Campion, Alfred, Prof., F.I.C., The Royal Technical College, Glasgow
1896		Candy, Hugh Charles Herbert, B.A. and B.Sc. (Lond.), F.I.C., The College, London Hospital, E.
1898		Cannon, Matthew James, 16 and 17, Devonshire-square, Bishopsgate-street, E.C.
1910		Canton, Howard, Brockenhurst, Finchley-road, Golder's Green, N.W.
1910		Cardoso, Ettore, D. ès Sc. (Grenoble), 3, Grande-rue, Geneva, Switzerland
1888		Carey, Alfred Edward, M.Inst.C.E., 36, Victoria-street, S.W.
1892	Trans.	Carey, Arthur, B.Sc. (Vict.), 1, Grassendale-road, Grassendale, near Liverpool
1909		Carey, William Gordon, F.I.C., Faireholme, Raby-road, Stockton-on-Tees
1906		Carmichael, John, Government Laboratory, Clement's Inn-passage, Strand, W.C.

Date of
Election.

1911		Carmichael, John Fisher, B.Sc. (Vict.), Tower Building, Liverpool
1902		Carmichael, Thomas Burnell, 62, Cambridge-road, Seaforth, Liverpool
1889		Carmody, Patrick, Prof., F.I.C., Department of Agriculture, Port of Spain, Trinidad
1899	Trans.	|| Carpenter, Henry Cort Harold, Prof., M.A. (Oxon.), Ph.D. (Leipzig), The University, Manchester; and 11, Oak-road, Withington, Manchester
1906		Carpenter, Percy Henry, F.I.C., Tocklai Experimental Station, Cinnamara, P.O., Assam, India
1899		Carpmael, Wilfred, 24, Southampton-buildings, Chancery-lane, W.C.
1895	Trans.	|| Carr, Francis Howard, F.I.C., Kelvin, Church-avenue, Sidcup, Kent
1887		Carrington, George Carrington, Missenden Abbey, Great Missenden, Bucks.
1902		Carrodns, Fred, Glen Cairn, The Ridgway, Wimbledon, S.W.
1882		|| Carruthers, Robert, Kirkbank House, Dumfries
1893		Carswell, Thomas Retson, 38, Palace-road, Upper Norwood, S.E.
1867		|| Carulla, Faundo Joaquin Ramon, Argyll-terrace, 84, Rose-hill-street, Derby
1913		Caruth, Alexander, A.R.C.S., 101, Singleton-avenue, Prenton, Birkenhead
1895		Case, Thomas Bennett, B.A. (Oxon.), Brewers' Laboratory, Messrs. Guinness, Son & Co., Dublin
1879		|| Cassal, Charles Edward, Col., V.D., F.I.C., Town Hall, Kensington, W.
1907	Trans.	Caton, Frederic William, M.A. (Oxon.), B.Sc. (Lond.), Technical College, Stafford
1903		|| Caudwell, Ben, B.A. (Lond.), 29, Sale-hill, Sheffield
1909		Caulkin, Howard Alfred, B.Sc. (Lond.), F.I.C., Oaklands, Solihull, Birmingham
1898	Trans.	Caven, Robert Martin, D.Sc. (Lond.), F.I.C., University College, Nottingham
1912		Chakraborty, Jatindranath, B.A. (Calcutta), The Oriental Soap Factory, Goabagan, Calcutta, India
1902		Challen, Matthew Bradbury, School of Mines, Daylesford, Victoria, Australia
1910	Trans.	Challenger, Frederick, B.Sc. (Lond.), Ph.D. (Göttingen), A.I.C., The University, Edgbaston, Birmingham
1912		Challinor, Richard Westman, F.I.C., Quidington, Emmerick-street, Leichhardt, Sydney, N.S.W.
1874		Chaloner, George, South-street, Colyton, Devon
1906		Chamberlain, Percy Garratt, M.A. (Cantab.), 3, Market-place, Rugby

Date of Election.		
1909		Chambliss, Hardee, Prof., M.S. (Vanderbilt), Ph.D. (Johns Hopkins), Department of Chemistry, Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, U.S.A.
1883		|| Chambres, Gordon Crewe, Rev., M.A. (Oxon.), 31, Upper Dicconson-street, Wigan
1883		|| Chance, Alexander Macomb, J.P., c/o Messrs. Chance and Hunt, Ltd., Chemical and Cement Works, Oldbury, Birmingham
1902		|| Chance, Kenneth Macomb, M.A. (Cantab.), c/o The British Cyanides Co., Ltd., Oldbury, Birmingham
1909		Chand, Lakshami, M.A. (Allahabad), B.Sc. (Vict.), c/o Messrs. Ram Chand Bulakidas, Naudan Sahn's-street, Benares City, India
1872		|| Chandler, Charles Frederick, Prof., Ph.D. (Göttingen), Columbia University, West 116th-street, New York City, U.S.A.
1889		|| Chaplin, Edward Mitchell, Ph.D. (Würzburg), F.I.C., Public Analyst's Office, Wakefield
1886	Trans.	C. 1908-10
1895		
		Chapman, Alfred Chaston, F.I.C., 8, Duke-street, Aldgate, E.C.
		Chapman, Arthur Jenner, F.I.C., c/o Messrs. F. Claudet, Ltd., 6 and 7, Coleman-street, E.C.
1898	Trans.	|| Chapman, David Leonard, M.A. (Oxon.), F.R.S., Jesus College, Oxford
1899	Trans.	Chapman, Edgar Marsh, F.I.C., Cairnsmore, Manor-road, Scarborough
1891		Charles, Rhys Pendrill, F.I.C., Bacteriological Laboratory, King's College, Strand, W.C.
1911		Charlton, Edwin Johnson, M.Sc. (Manc.), Bron Menai, Beaumaris, Anglesey
1900		Chater, Arthur Brand, 65, Queen-street, Brisbane, Queensland
1894	Trans.	C. 1900-03
		Chattaway, Frederick Daniel, M.A. (Oxon.), D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), F.R.S., F.I.C., 151, Woodstock-road, Oxford
1895		Cheadle, Walter William, M.A. (Oxon.), Woodlands, Bridge-road, Grays
1899		Cheater, Thomas John, B.Sc. (Lond.), 18, Queen Anne's grove, Bedford Park, W.
1900		Cheeseright, John Henry, B.Sc. (Lond.), Secondary School, Gateshead-on-Tyne
1912		Cheshire, Frank Lothian, Mines Dept., Brisbane, Queensland, Australia
1908		Chew, John Henry, 46, Lytham-road, Blackpool
1897	Trans.	Chikashigé, Masumi, D.Sc. (Kyoto), College of Science and Engineering, Imperial University, Kyoto, Japan
1910		Child, Arthur James, Oaklands, Canon's-park, Edgware, Middlesex

Date of
Election.

1897		Cholerton, Alfred Foster, c/o Messrs. A. de St. Dalmas & Co., 40 $\frac{1}{2}$, Belgrave-gate, Leicester
1891	Trans.	|| Chorley, John Christmas, Bewsey, Oxford-road, Birkdale, Lanes.
1907		|| Christie, John, B.A. (Cantab.), Eton College, Windsor
1913		Christie, John Hugh, B.Sc. (Lond.), c/o Dr. Bean, Cross Gates, Leeds
1874		Christopher, George, Walkden Works, Verney-road, Bermondsey, S.E.
1911	Trans.	Christopher, Harold, B.Sc. (Lond.), c/o Messrs. Joseph Crosfield & Sons, Ltd., Warrington
1882		Chrystal, William James, F.I.C., 7, West George-street, Glasgow ; and Shawfield Works, Rutherglen, near Glasgow
1906	Trans.	Chrystall, Edwin Rodney, B.Sc. (Lond.), F.I.C., c/o Messrs. Curtis's and Harvey, Explosives Works, Cliffe-at-Hoo, Kent
1856	Trans.	(C. 1876-180, 87-90) || Church, Sir Arthur Herbert, K.C.V.O., M.A. and D.Sc. (Oxon.), F.R.S., F.I.C., Shelsley, Kew, Surrey
1888	Trans.	Claisen, Ludwig, Geh. Rat Prof., Ph.D. (Bonn), Augustastrasse 24, Godesberg-am-Rhein, Germany
1901	Trans.	Clark, Ernest, B.Sc. (Lond.), Royal Technical Institute, Salford ; and 16, Havelock-street, Sheffield
1892		Clark, Ernest Victor, 2, St. Anne's-villas, Lewes
1905		Clark, Friend Ebenezer, Prof., B.Sc. (West Virg.), Ph.D. (Johns Hopkins), The Central University of Kentucky, Dannville, Ky., U.S.A.
1912		|| Clark, Leslie Melville, 8, Harley-road, Hampstead, N.W.
1905		Clark, Thomas Walter Firth, 11, Quadrant-road, Canonbury, N.
1911		Clarke, Arthur Frederick, 66, May-road, Gillingham, Kent
1909	Trans.	Clarke, George, Department of Agriculture, Cawnpore, U.P., India
1908	Trans.	|| Clarke, Hans Thacher, B.Sc. (Lond.), F.I.C., Gayton-corner, Harrow
1910	Trans.	Clarke, Herbert Edmund, M.A. and B.Sc. (Oxon.), 20, Grosvenor-road, Jesmond, Newcastle-on-Tyne
1906	Trans.	Clarke, Reginald William Lane, B.Sc. (Lond.), F.I.C., 15, Torridon-road, Catford, S.E.
1912		Clarke, William Thomas, B.Sc. (Lond.), Secondary and Technical School, Heanor, Derbyshire
1905		Clarkson, George Douglas, Hollindon, St. Paul's-road, Mirfield, Yorks.
1909	Trans.	Clayton, Arthur, D.Sc. (Lond.), 116, Halifax Old-road, Birkby, Huddersfield
1882	Proc.	Clayton, Edwy Godwin, F.I.C., 23, Holborn-viaduct, E.C.
1904		Clayton, Ellis, Hazeldene, Deerpark-road, Belfast

Date of Election.		
1889		Clayton, John William, 3 and 5, Concert-street, Liverpool
1908		Clement, Leonard, M.A. (Cantab.), F.I.C., Beamsley, Fairhaven, near Lytham
1875		Clerk, Dugald, Hon. D.Sc. (Manc.), F.R.S., 57 and 58, Lincoln's Inn Fields, W.C.
1902		Clifford, William, Sewage Outfall Works, Wolverhampton
1913		Clotworthy, Harold Reginald Septimus, B.A. (Dub.), B.Sc. (Lond.), 39, Trinity College, Dublin
1878		Cloud, Thomas Charles, A.R.S.M., F.I.C., 479, Mansion House-chambers, E.C.
1907	Trans.	Clough, George William, B.Sc. (Birm.), Birkbeck College, Breams Buildings, Chancery-lane, E.C.
1902		Clough, William Thomas, A.R.C.S., Chelladene, St. Margaret's-road, Wanstead Park, Essex
1869	Trans.	{C. 1885-} || Clowes, Frank, Prof., D.Sc. (Lond.), F.I.C., The Grange, College-road, Dulwich, S.E. {90, 99-03}
1902		Clowes, George Henry Alexander, Ph.D. (Göttingen), Gratwick Research Laboratory, The University, Buffalo, U.S.A.
1897		Clutterbuck, Medwin Caspar, B.Sc. (Lond.), Ph.D. (Strassburg), 61, Beaconsfield-villas, Brighton
1905	Trans.	Coates, Joseph Edward, M.Sc. (Wales), The University, Edgbaston, Birmingham
1887		Coates, William Henry, M.A., M.B. and L.S.A. (Dun.), M.R.C.S., L.R.C.P. and L.S.A. (Lond.), 7, Albion-street, Hull
1896		Cobb, Walter William, M.A. (Oxon.), Hilton House, Atherstone
1890		Cobbold, Paul Alexander, M.A. (Cantab.), Haileybury, Ontario, Canada
1895		Coblentz, Virgil, Prof., Ph.D. (Berlin), 23, Vine-street, Brooklyn, U.S.A.
1880		|| Cockburn, Arthur Cecil, Bridge House, 181, Queen Victoria-street, E.C.
1906		Cockburn, Charles Taylor, 34, Queen's - gate, Dowanhill, Glasgow
1892		Cockerill, Thomas, Technical College, Colombo, Ceylon
1893		Cocking, Allan Thomas, Carhampton House, Four Oaks, Sutton Coldfield
1888		|| Cocking, Lewis Smith, Rashcliffe Dyewood Mills, Huddersfield
1902		Cockle, Charles, Belsay, Weeke-hill, Winchester
1910		Cocks, Reginald Henry, M.A. (Oxon.), 58, Norbiton-avenue, Kingston-on-Thames
1913		Cockshutt, John Albert, M.Sc. (Manc.), Queen's College, Taunton
1901		Coddington, Eustace, M.A. (Cantab.), St. John's School, Leatherhead

Date of
Election.

1903			Codling, Arthur John, 5, Tavistock-square, W.C.
1881			||Coffin, Walter Harris, The National Liberal Club, Whitehall-place, S.W.
1885	Trans.	C. 1908-12	Cohen, Julius Berend, Prof., Ph.D. (Mnnich), B.Sc. (Vict.), F.R.S., The University, Leeds; and 1, North Grange-mount, Headingley, Leeds
1901			||Cohen, Robert Waley, M.A. (Cantab.), 11, Sussex-square, W.
1912			Colclough, Tom Peach, M.Sc. (Manc.), Worksop-road, Handsworth, Sheffield
1891	Trans.		Colefax, Arthur, M.A. (Oxon.), Ph.D. (Strassburg), M.P., 4, Brick-court, Temple, E.C.
1883			Coleman, Joseph Bernard, F.I.C., S.W. Polytechnic Institute, Manresa-road, Chelsea, S.W.
1909			Coles, Alfred Bertram, M.A. (Oxon.), 42, Broadwater-road, Tottenham, N.
1910	Trans.		Colgate, Reginald Thomas, B.Sc. (Lond.), A.C.G.I., 26, Birdhurst-rise, S. Croydon
1883			Collenette, Adolphus, Brooklyn, Fort-road, Guernsey
1908			Collens, Archibald Edgar, Government Laboratory, Port of Spain, Trinidad
1905	Trans.		Colles, William Morris, jun., B.Sc. (Lond.), Chemical Laboratory, School of Medicine, Cairo, Egypt
1881			Collett, John Marton, Kimsbury House, Gloucester
1910			Collett, Ronald Leslie, B.A. (Cantab.), F.I.C., Manor Lodge, Hayes, Hayes End, Middlesex
1885	Trans.	(C. 1889-94, 1900-1 V.P. 1909-12)	||Collie, John Norman, Prof., Ph.D. (Würzburg), Hon. D.Sc. (L'pool, and Belfast), F.R.S., F.I.C., 16, Campden-grove, Kensington, W.
1908	Proc.		Collier, William Henry, B.Sc. (Lond.), 13, Chatsworth-avenue, Wembley Hill, Middlesex
1897			Collingridge, Frank, B.Sc. (Lond.), F.I.C., Highstone, New-road, Llanelly
1911			Collington, John Eric, 11, Noel-road, Edgbaston, Birmingham
1892			||Collins, Hugh Brown, Major, B.Sc. (Glas.), Auchinbothie Estate Office, Kilmacolm, Renfrewshire
1890			||Collins, Sydney Hoare, M.Sc. (Dun.), F.I.C., Armstrong College, Newcastle-on-Tyne
1886			Collins, Walter Hepworth, Junior Constitutional Club, Piccadilly, W.
1905			Collitt, Bernard, 47, South-park, Lincoln
1887	Trans.	C. 1912-	||Colman, Harold Govett, D.Sc. (Vict.), Ph.D. (Würzburg), F.I.C., Woodthorpe, New Malden, Surrey
1890			Colwell, James Kear, F.I.C., Clerkenwell Town Hall, Rosebery-avenue, E.C.

Date of Election.	
1900	Comber, Albert Walter, F.I.C., Dinwaed, Victoria-avenue, Southend-on-Sea
1892	|| Comyns, Frank, M.A. (Oxon.), Bryum, Craven-road, Newbry
1899	Connah, James, B.Sc. (Lond.), F.I.C., The Laboratory, Custom House, E.C.
1875	Connor, Charles Cunningham, B.A. (Q.U.I.), 4, Queen's-elms, Belfast
1883	|| Conrad, Edwin Charles, 13, Frobisher-terrace, Falmouth
1906	Conyngham, William Boulton, c/o Messrs. Benger's Food, Ltd., 92, William-street, New York City, U.S.A.
1875	Trans. || Cook, Ernest Henry, D.Sc. (Lond.), F.I.C., The Clifton Laboratory, 27, Berkeley-square, Clifton, Bristol
1895	Cook, Herbert William, B.Sc. (Lond.), Education Dept., Charia Abdine, Cairo, Egypt
1907	Cook, Taylor, B.Sc. (Lond.), A.R.C.S., Burgh Academy, Kilsyth, Glasgow
1890	Cooke, Arthur William, c/o Messrs. Brotherton and Co., Holmes-street, Dewsbury-road, Leeds
1911	Cooke, Charles Ernest, 35, Sebert-road, Forest Gate, E.
1909	Cooke, Reginald Cyril Herbert, Salisbury Club, Salisbury, Rhodesia, S. Africa
1888	Cooley, Walter Bromley, 5, Dudley-street, Wolverhampton
1912	Coombs, Frank Andrew, Technical College, Sydney, N.S.W.
1909	Coope, John Charles Jesser, Hillside, Bulawayo, Rhodesia, S. Africa
1898	|| Cooper, Albert John Bullen, 80, Gloucester-road, South Kensington, S.W.
1892	Cooper, Arthur James, B.A. (Dub.), B.Sc. (Lond.), F.I.C., Solihull School, Solihull, Birmingham
1908	Cooper, Charles Duncan, The Laboratory, Tiptree, Essex
1912	Cooper, Evelyn Ashley, B.Sc. (Lond.), Arborfield, Woodcote Valley-road, Purley, Surrey
1909	Cooper, George Stanley, Heaton House, Cleckheaton
1906	Cooper, Herbert Reginald, B.Sc. (Lond.), Redington, Northwood, Middlesex
1904	Cooper, Jabez Horace, B.A. (Oxon.), 13, Victoria-terrace, Exeter
1898	Cooper, John Burdon, M.D., B.S. and B.Sc. (Dun.), 22, The Circus, Bath
1910	Cooper, Leonard Harry, c/o Royal Crown Soap Co., Calgary, Alberta, Canada
1900	Trans. Cooper, William Francis, B.A. (Cantab.), The Laboratory, Rickmansworth-road, Watford
1891	|| Cooper, Walter Johnson, The Elms, Lavernock, near Penarth

Date of
Election.

1894	Proc.	Coote, Arthur Herbert, B.Sc. (Lond.), 59, Foyle-road, Blackheath, S.E.
1899	Trans.	Cope, Frank, c/o Messrs. Graham & Cope, Ltd., Globe Mills, Dewsbury
1913		Coppin, Noël Guilbert Stevenson, M.Sc. (Liv.), Rydal Mount, Runcorn
1890		||Coppock, John Bridgeford, B.Sc. (Lond.), F.I.C., Lee-lane, Horsforth, Leeds
1891	Trans.	Corbett, Charles Henry, The Avenue, Trowbridge, Wilts.
1888		||Cornish, Vaughan, D.Sc. (Vict.), Woodville, Camberley
1906		Cornwall, Reginald de Vere, Medical and Public Health Dept., Salisbury, Rhodesia, S. Africa
1890		Corrie, David, Nobel's Explosives Co., West Quarter Factory, Polmont Station
1910		Coslett, Thomas Watts, Norman-road, Northfield, Birmingham
1893	Trans.	||Coste, John Henry, F.I.C., Utopia, Gloucester-road, Teddington, Middlesex
1909		Couch, David Little, c/o The Standard Dye and Colour Co., Ltd., 14, Deanery-road, Stratford, E.
1892		||Couldrey, Henry, c/o Messrs. Thos. Cook & Son, Ludgate-cirens, E.C.
1906	Trans.	Courtauld, Stephen Lewis, M.A. (Cantab.), Highfield, Burton-on-Trent
1900		||Courtman, Ernest Owen, Denford House, Atkins road, Clapham Park, S.W.
1903		||Cousins, Francis George, B.Sc. (Lond.), 1, St. Cuthbert's-place, Durham
1901	Trans.	Cousins, Herbert Henry, M.A. (Oxon.), Government Laboratory, Kingston, Jamaica
1885		Cousins, William James, F.I.C., 55, Clerkenwell-close, E.C.
1886	Trans.	||Coutts, Francis James Henderson, M.D., B.Ch., B.Sc., and D.P.H. (Vict.), Rusland, Gloucester-road, Kingston Hill, Surrey
1909	Trans.	Couzens, Edward Gordon, B.Sc. (Lond.), A.R.C.S., 18, Crocker-ton-road, Upper Tooting, S.W.
1910		Coventry, Bernard Okes, Imperial Forest Service, Dehra Dun, U.P., India
1908		Coverdale, Arthur Edward, 68, Broad-street, Worcester
1907	Trans.	Cowap, Matthewman Dalton, Combe Bank, near Sevenoaks
1906	Trans.	Coward, Hubert Frank, D.Sc. (Manc.), 216, Plymouth-grove, Manchester
1898		Cowburn, Arthur William, 20, Mount-street, Manchester
1908		Cowburn, John Robert, 10, Eastwood-road, South Woodford, Essex
1882		||Cowie, Thomas Rennie, Garnkirk House, Garnkirk

Date of Election.		
1905		Cowie, William Beaverly, 26, East Claremont-street, Edinburgh
1908		Cowley, Robert Charles, College of Pharmacy, Brisbane, Queensland, Australia
1898		Cowling, Frederick, Technical Schools, Clay Cross, near Chesterfield
1911		Cowling, Thomas, Chapel-street, Easingwold, Yorks.
1904		Cowper, Alfred Denys, B.Sc. (Lond.), 8, Sandown-terrace, Deal, Kent
1888		Cowper, Joseph, 50, King-street, Penrith
1898		Cox, Frederick Hudson-, F.I.C., 67, St. Thomas'-street, Weymouth
1904		Crabb, William, B.A. and B.Sc. (Lond.), 5, Edridge-road, Croydon
1870	Trans.	Crafts, James Mason, Prof., 111, Commonwealth-avenue, Boston, Mass., U.S.A.
1897	Trans.	Craig, Andrew William, College of Pharmacy, 360, Swanston-street, Melbourne, Victoria
1910		Cram, Marshall Perley, A.M. (Bowdoin), Ph.D. (Johns Hopkins), Bowdoin College, Brunswick, Maine, U.S.A.
1897		Cranfield, William, The Higher Grade Board School, Halifax
1910		Crawford, David Chalmers, M.A., B.Sc. and B.Sc. Agric. (Aberd.), Government College of Agriculture, Elsenburg, Mulders Vlei, Cape Colony, S. Africa
1909	Trans.	Creighton, Henry Jermain Maude, M.A. (Dalhousie), M.Sc. (Birm.), D.Sc. (Zürich), Assistant Professor of Chemistry, Swarthmore College, Swarthmore, Penn., U.S.A.
1909		Crewe, Philip Henry, Glencairn, Woods Moor-lane, Stockport
1887		||Cribb, Cecil Howard, B.Sc. (Lond.), F.I.C., 136, Shaftesbury-avenue, W.
1910		Crichton, Charles, Kleinfontein Group, C.A., Box 2, Benoni, Transvaal, S. Africa
1878		||Criper, William Risdon, A.R.S.M., F.I.C., Chemical Works, Konnagar, Calcutta, India
1906		Crocker, Henry Ernest, c/o The Birmingham Carbon Works, Witton, Birmingham
1902	Trans.	Crocker, James Codrington, M.A. (Cantab.), D.Sc. (Lond.), South Western Polytechnic, Manresa-road, and 3, Alexandra-mansions, Beaufort-street, Chelsea, S.W.
1901		Crocker, Walter Stevens, A.R.C.S., 39, Arnold-street, Princes Park, Liverpool
1897	Trans.	Crofts, James Murray, M.A. (Cantab.), B.Sc. (Lond.), 24, Talbot-street, Southport, Manchester
1886	Trans.	||Crompton, Holland, Oaklyn, Cross Oak-road, Berkhamsted
1911		Crook, Clement Arthur, 5, Avondale-place, Manor-drive, Halifax

Date of
Election.

1902			Crookes, Henry, 109, Ladbroke-grove, Notting Hill, W.
1901	Trans.		Crookes, Samuel Irwin, Marama-avenue, Owen's-road, Epsom Auckland, New Zealand
1857	Trans.	{ C. 1866-70 V.P. 76- 9, 85-7 P. 87-9 }	|| Crookes, Sir William, O.M., D.Sc. (Oxon., R.U.I., Sheffield, Cape of Good Hope), Hon. LL.D. (Birm.), F.R.S., F.I.C., 7, Kensington Park-gardens, W. ; and Athenæum Club, Pall Mall, S.W.
1879	Trans.	{ C. 1890-1, 93-5, 1911-12 }	|| Cross, Charles Frederick, B.Sc. (Lond.), F.I.C., 3, New-court, Carey-street, W.C.
1890	Trans.	{ C. 1901-2 S. 1905-13 F.S. 1913- }	|| Crossley, Arthur William, Prof., D.Sc. (Vict.), Ph.D. (Würzburg), F.R.S., F.I.C., Pharmaceutical Society, 17, Bloomsbury-square, W.C. ; and 10, Crediton-road, West Hampstead, N.W.
1896			Crossman, Charles Matthew, B.Sc. (Lond.), Cannon House, Watford, Herts.
1898			Cronch, William Samuel, c/o General Post Office, Perth, Western Australia
1880	Trans.		Crow, John Kent, D.Sc. (Lond.), F.I.C., Ivydene, Westcombe- park-road, Blackheath, S.E.
1887			|| Crowther, Horace Woodward, F.I.C., The Beeches, West Bromwich
1912			Crowther, Raymond Edwin, Edenvale, Wigton-road, Carlisle
1884			Crumbie, William Drake, 146, Washington-street, East Orange, N. J., U.S.A.
1913			Crutchley, Arthur Ernest, 230, Albert-road, Handsworth, Birmingham
1911	Trans.		Crymble, Cecil Reginald, B.Sc. (R.U.I.), Chemical Laboratory, University College, Gower-street, W.C.
1910	Trans.		Cumming, Alexander Charles, D.Sc. (Melbourne), Chemistry Department, The University, Edinburgh
1887	Trans.		Cundall, James Tudor, B.Sc. (Lond.), F.I.C., Edinburgh Academy, Henderson-row, and 1, Dean-park-crescent, Edin- burgh
1904			Cunningham, James Edward, Minas Peña del Hierro, Provincia del Huelva, Spain
1912			Curtis, Frederic Fernandez, 20, Bury-street, Bloomsbury, W.C.
1900			Cussons, John, B.Sc. (Vict.), P.O., Fauresmith, Orange River Colony, S. Africa
1881			|| Custance, John D., Prof., Hazeldean, William-street, Hawthorn, S. Australia
1913			Cutbush, Charles George, 55, Byne-road, Sydenham, S.E.
1895			|| Cutbirtson, Lionel Mould Gurney, 89, Lordship Park, N.
1911			Cutner, Morris, B.Sc. (Lond.), 222, St. Thomas'-road, Preston

Date of
Election.

1894		Dains, Herbert Henry, F.I.C., 7, Mount View-road, Crouch Hill, N.
1901	Trans.	Dakin, Henry Drysdale, D.Sc. (Vict.), F.I.C., 819, Madison-avenue, New York City, U.S.A.
1913		Dalal, Vasanji Premji, M.A. and B.Sc. (Bombay), Pension Scherrer, Heidelberg, Germany
1907		Dall, Colin Ernest, B.Sc. (Lond.), Rosendene, Guston, Dover
1912		Dallas, William, Burnbank Cottage, Mount Vernon, Glasgow
1905		Dallman, Arthur Augustine, 63, Sea View-road, Wallasey, Birkenhead
1904		Dalton, William Herbert, 85, Hayter-road, Brixton Hill, S.W.
1901	Trans.	Daniel, Gilbert Howard, B.Sc. (Lond.), 25, Church-walk, Ulverston
1887		Daniell, Louis Charles, Royal Standard Brewery, Tamworth, N.S.W.
1892	Trans.	Darbishire, Francis Vernon, B.A. (Oxon.), Ph.D. (Leipzig), South Eastern Agricultural College, Wye, Kent
1899		Darling, Charles Robert, A.R.C.S.I., F.I.C., 186, Eglinton-road, Plumstead, Kent
1891		Darling, Thomas, Adderstone House, Berwick-on-Tweed
1871	Trans.	|| Darling, William Howarth, F.I.C., 26, Dover-street, Manchester
1912		Das, Bhupati Nath, Prof., M.A. (Calcutta), B.Sc. (Lond.), Dacca College, Dacca, Eastern Bengal, India
1910	Proc.	Das, Tarak Nath, B.Sc. (Allahabad), 31, Bhaironath, Benares City, U.P., India
1911		Datta, Atul Chandra, Prof., M.A. (Calcutta), St. John's College, Bâg Muzaffarkhan, Agra, U.P., India
1911		Datta, Ganesh, B.A. (Punjab), Dera Ismail Khan, N.W.F.P., India
1875		|| Davey, G. William, 22, Tubbs-road, Harlesden, N.W.
1905		Davey, Joseph Morgan, Shelono House, Briton Ferry, Glam.
1897		Davidge, Henry Norris, 23, Rydal-road, Streatham, S.W.
1900		Davidson, Alexander, jun., F.I.C., 173, Colinton-road, Edinburgh
1906		Davidson, Charles, 65, Cadder-street, Pollokshields, Glasgow
1898	Trans.	Davidson, William Brown, M.A. and D.Sc. (Aberd.), Ph.D. (Würzburg), F.I.C., Saltley Gas Works, Birmingham
1866	Trans.	|| Davies, Arthur Ellson, Ph.D., Tweedbank, West Savile-road, Edinburgh
1913		Davies, Daniel James, B.Sc. (Sheffield), 177, Le Marchant-road, St. John's, Newfoundland
1858	Trans.	Davies, Edward, The Laboratory, 28, Chapel-street, Liverpool

Date of
Election.

1913	Trans.	Davies, Harold, A.I.C., 18, Windsor-road, Ilford
1910	Trans.	Davies, John Hughes, B.Sc. (Wales), Ph.D. (Leipzig), Deacon's School, Peterborough
1905		Davies, John Llewelyn, M.A. (Cantab.), The Perse School, Cambridge
1896		Davies, Llewellyn John, Bute-chambers, Bute-road, Cardiff
1894	Trans.	Davies, Samuel Henry, B.Sc. (Viet.), Messrs. Rowntree & Co., Ltd., York
1900		Davis, Arthur Charles, 2, Downing-grove, Cambridge
1902		Davis, Charles Benson, c/o Dr. Francis Wyatt, S.W.-corner, 23rd-street and 9th-avenue, New York City, U.S.A.
1857		|| Davis, John Frederick, c/o Dr. J. Lewis, Government Analytical Laboratory, Grahams'town, S. Africa
1876		|| Davis, Walter Charles, The Chestnuts, Durdham Down, Bristol
1897	Trans.	Davis, William Alfred, B.Sc. (Lond.), 7, Carlton-bank, Harpenden, Herts.
1900		Davison, Thomas Cuthbert, Bower-hill, Exmouth-street, Swindon
1906		Davson, Archibald Prideaux, A.R.C.S., F.I.C., 16, Airedale-road, South Ealing, W.
1912		Davys, Gerard Irvine, Capt. I.M.S., B.A., M.D., B.Ch., and D.P.H. (Dub.), D.T.M. and H. (Cantab.), c/o Messrs. Grindlay, Groom & Co., Bombay, India
1900	Trans.	Dawson, Harry Medforth, D.Sc. (Leeds), B.Sc. (Lond.), Ph.D. (Giessen), The University, Leeds; and 23, Claremont-drive, Headingley, Leeds
1909		Dawson, James Ferguson, B.Sc. (Mane.), Maywood, Penicuik, Midlothian
1890		Day, Charles Edwin, B.Sc. (Edin.), 294, Baker-street, Enfield, Middlesex
1881	Trans.	|| Day, Thomas Cuthbert, 36, Hillside-crescent, Edinburgh
1905		Day, William Walpole, B.Sc. (Wales), Llandilo, Attleborough-road, Nuneaton
1912		Do, Surendra Nath, L.M.S., 52, Brojanath Dutt-lane, Calcutta, India
1907		Dealy, Thomas Kirkman, Craigin East, Craigin-road, The Peak, Hong Kong, China
1901	Trans.	Dean, George, M.A. (Cantab.), 107, Earlham-grove, Forest Gate, E.
1904		Deane, Harold, B.Sc. (Lond.), F.I.C., St. Olave's, Sudbury, Suffolk
1859	{ V.P. 1871-4 }	Debus, Heinrich, Prof., Ph.D. (Marburg), F.R.S., Schlangenberg, 4, Cassel, Provinz Hessen, Germany

Date of
Election.

1898	Trans.	|| De Castro, John Paul, M.A. (Cantab.), F.I.C., 1, Essex-court, Temple, E.C.
1885	Trans.	Dechan, Martin, F.I.C., Laboratory of Public Analyst, Hawick
1869	Trans.	|| Deering, William Henry, I.S.O., F.I.C., Beauworth, Moreton-hampstead, Devon
1900	Proc.	Deerr, Noël Fielding, F.C.G.I., Experiment Station, Hawaiian Sugar Planters' Association, Honolulu, H.I., U.S.A.
1902		|| De la Rue, Sir Evelyn Andros, Bart., B.A. (Oxon.), 110, Bunhill-row, E.C.
1905		De Lury, Ralph Emerson, M.A. and Ph.D. (Toronto), The Dominion Astronomical Observatory, Ottawa, Canada
1911		Demuth, Rudolph, 68, Salusbury-road, N.W.
1907	Trans.	Denham, William Smith, D.Sc. (St. Andrews), F.I.C., The United College, St. Andrews
1892		Denison, Joseph Richard, c/o Messrs. Denison, Preussner & Co., Valley Dyeworks, Bradford
1902		Dennis, William, Saxilby, Lincoln
1906		Denton, John, Moor Bank, Utley, Keighley
1903	Trans.	Desch, Cecil Henry, D.Sc. (Lond.), Ph.D. (Würzburg), F.I.C., Metallurgical Laboratory, The University, Glasgow
1897		|| Deverell, Louis Charles, Brantwood, Shortlands-grove, Shortlands, Bromley, Kent
1911		Devlin, James Edwin Augustine, A.I.E.E., Government School, Vryheid, Natal, S. Africa
1870	Trans.	|| Dewar, Sir James, Prof., M.A. (Cantab.), Hon. LL.D. (St. Andrews, Aberd., Edin., Glas.), Hon. D.Sc. (Oxon., Dub., Vict., Ireland), Ph.D. (Christiania), F.R.S., F.I.C., Royal Institution, Albemarle-street, W.
1899		Dewhirst, John Arthur, F.I.C., The Borough Laboratory, George-square, Halifax
1880		Dibdin, William Joseph, F.I.C., 2, Edinburgh-mansions, Howick-place, Victoria-street, S.W.; and 1, Marlborough-place, St. John's Wood, N.W.
1912		Dick, Thomas Sharp, 10, Steel-street, Gourrock, Renfrewshire
1872		|| Dickinson, Arthur John, F.I.C., 178, Lewisham-high-road, Brockley, S.E.
1908	Trans.	Dickinson, Cyril, B.Sc. (Vict. and Leeds), F.I.C., Southwark Town Hall, Walworth-road, S.E.
1911		Dickinson, William Henry, Prof. Major, I.M.S., M.B., and Ch.B. (Edin.), F.I.C., Grant Medical College, Bombay, India
1898		Dickson, Samuel, Chemical Laboratory, 2, Broadway, Westminster, S.W.
1910	Trans.	Dickson, Thomas William, B.A. (Oxon.), c/o John Henderson Esq., 60, Jeffrys-road, Clapham, S.W.

(C. 1874-7
V.P. 80-3
86-8, 96-7
P. 97-9)

Date of
Election.

1906			Dickson, William, A.I.C., Hillside, Linlithgow
1912			Dieffenthaler, George Cruden, 7, Darcueil-lane, Belmont, Port of Spain, Trinidad
1907			Dikshit, Mohan Nath Kedarnath, Amliran, Surat, India
1906			Dinwoodie, James Herbert, 71, Bree-street, Johannesburg, S. Africa
1913			Dix, Alfred Gilbert, B.Sc. (Lond.), 110, Tufnell Park-road, Holloway, N.
1897			Dixon, Andrew James, F.I.C., 97, Pitt-street, Sydney, N.S.W.
1885	Trans.	C. 1900-06	Dixon, Augustus Edward, Prof., M.D. (Dub.), University College, and Fernhurst-avenue, Western-road, Cork
1896	Trans		Dixon, Frank, B.Sc. (Lond.), The Institute, Lydney, Gloucester
1894	Proc.		|| Dixon, George, Lieut-Col., M.A. (Cantab.), Trinity College, Cambridge; and St. Bees, Cumberland
1876	Trans.	{C. 1892-6 V.P. 1904-7 P. 1909-11}	|| Dixon, Harold Baily, Prof., M.A. (Oxon.), Hon. Ph.D. (Prague), F.R.S., The University, Manchester; and 10, Wilbraham-road, Fallowfield, Manchester
1893			Dixon, Harry William, 32, Grange-view, Chapeltown-road, Leeds
1912			Dixon, Walter Henry, 53, High-street, East Grinstead
1895			Dixon, William, 102, Spring-street, Bury
1862			Dixon, William Adam, F.I.C., 97, Pitt-street; Sydney, N.S.W.
1882	Trans.	{C. 1901-6 V.P. 1907-11}	Dobbie, James Johnston, Prof., M.A. (Glas.), D.Sc. (Edin.), F.R.S., F.I.C., 4, Vicarage-gate, Kensington, W.
1887	Trans.		Dobbin, Leonard, Ph.D. (Würzburg), F.I.C., Chemical Laboratory, New University-buildings, Edinburgh
1910			Dodd, Alexander Scott, B.Sc. (Edin.), F.I.C., 173, Bruntsfield-place, Edinburgh
1910			Dodd, Arthur, Lyndhurst, Belvedere, Kent
1898			|| Dodd, Frederick Robertson, F.I.C., Welbank-villas, Liverpool-road, Aughton, Ormskirk
1901			Dodd, Robert, 56, Valley-road, Streatham, S.W.
1886			Dodd, William Ralph, Burton Grange, Goff's Oak, Waltham Cross
1892			Dodds, George Price, 5, Dixon-terrace, Darlington
1912			Dodds, Herbert Henry, M.Sc. (Manc.), c/o Messrs. Kynoch, Ltd., Umbogintwini, Durban, Natal, S. Africa
1905			Dodds, Roger, 7, Sion-place, Lansdown, Bath
1897	Proc.		Dodgson, John Wallis, B.Sc. (Lond.), University College, and 1, Erleigh-road, Reading
1912			Dodson, Harold Forster, 57, Southgrove-road, Sheffield
1894	Proc.		Doherty, William Michael, F.I.C., Government Laboratory, Sydney, N.S.W.
1905			Donald, Robert, M.A. and B.Sc. (N.Z.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. (Oxon.), Mental Hospital, Orokonui Home, Waitati, New Zealand

Date of
Election

1892			Donaldson, Hudson, The Laurels, St. Catharine's - road, Grantham
1901	Trans.	C. 1913-	Donnan, Frederick George, Prof., M.A. (R.U.I.), Ph.D. (Leipzig), F.R.S., University College, Gower-street, W.C.
1897	Trans.		Dootson, Frederick William, M.A. (Cantab.), D.Sc. (Dub.), F.I.C., University Chemical Laboratory, Cambridge
1902	Trans.		|| Dorée, Charles, M.A. (Oxon.), D.Sc. (Lond.), 58, Gore-road, N.E.
1912			Douglas, James Crawford, Christmas Island Phosphates Co., Ltd. Christmas Island, Straits Settlements
1912			Douglas, Robert Percy, Prudential Buildings, Nelson-square, Bolton
1888			|| Douglas, William, F.I.C., Grafton House, Berkhamsted
1905			Doull, John, 22, Lauriston-place, Edinburgh
1913			Donnin, Roland, 76, Tannsfeld-road, Sydenham, S.E.
1911			Douse, Oliver Statham, M.Sc. (Manc.), The Whare, Glossop
1884			Down, Frederick Johnathan, Glengariff, Milton-road, Harpenden, Herts.
1899			Doyle, Frederick, B.Sc. (Lond.), 3, Etterby-seaur, Carlisle
1884			Draper, Henry Carter, St. Kevin's, Sorrento-road, Dalkey, Co. Dublin
1891	Trans.		Dreaper, William Porter, F.I.C., 14, Old Queen-street, Westminster, S.W.
1893			Dreyfus, Charles, Ph.D., (Strassburg), Claremont, Fallowfield, Manchester
1902			Drought, James Justinian, Molo, <i>via</i> Mombasa, British East Africa
1895			Druce, Edric, The Shire Hall, Shrewsbury
1904	Trans.		Drugman, Julien, Ph.D. (Bonn), M.Sc. (Manc.), 117, Rue Gachard, Brussels
1913			Drummond, Jack Cecil, B.Sc. (Lond.), 8, Little-heath, Old Charlton, Kent
1911			Dryden, Harold Edgar, The Laboratory, Messrs. S. Allsopp & Sons, Ltd., Burton-on-Trent
1897			Duckham, Alexander, Vanbrugh Castle, Blackheath, S.E.
1907			Duckworth, Samuel, M.Sc. (Vict.), 81, Regent-road, Salford, Manchester
1901			Duckworth, William Henry, Weaste House, Borough-road, Salford
1890			|| Dudley, William Lofland, Prof., Vanderbilt University, Nashville, Tenn., U.S.A.
1892			Duffield, Walter William, 5, Ashington-road, Hurlingham, Fulham, S.W.
1893	Trans.		|| Dufton, Samuel Felix, M.A. (Cantab.), D.Sc. (Lond.), Laurel Bank, Claremont-road, Headingley, Leeds

Date of
Election.

1884		Duggan, Thomas Richard, F.I.C., 52, East 41st-street, New York City, U.S.A.
1889		Duisberg, Carl, Geh. Reg. Rat Prof., Ph.D., The Farbenfabriken, Leverkusen, bei Cöln am Rhein, Germany
1889		||Dukes, Thomas William, P.O. Box 10, Vrijheid, S. Africa
1881		Duncan, Arthur William, c/o Messrs. Jas. Woolley, Sons & Co., Ltd., Victoria Bridge, Manchester
1894	Proc.	||Duncan, Cecil Cooke, F.I.C., The Shire Hall, Worcester
1910		Duncan, James Hugh, 27, Richmond-road, Cardiff
1912		Duncan, John, 184, Pitt-street, Sydney, N.S.W.
1906		Duncan, Robert Kennedy, Prof., 4715, Wallingford-street, Pittsburg, U.S.A.
1891		Duncan, William, F.I.C., The Laboratory, 65, Bath-row, Edgbaston, Birmingham
1896		Duncan, William, Royal Dispensary, 21, West Richmond-street, Edinburgh
1905		Dunlop, Harry, 231, St. Vincent-street, Glasgow
1909	Trans.	||Dunlop, John Gunning Moore, M.A. (Cantab.), Caius College, Cambridge
1894	Proc.	||Dunn, Frederic, 193, Collins-street, Melbourne, Australia
1909	Trans.	Dunn, Frederick Percy, B.Sc. (Lond.), Haresfield, Chorley Wood, Rickmansworth, Herts.
1882		Dunn, John Thomas, D.Sc. (Dun.), F.I.C., 10, Dean-street, Newcastle-on-Tyne
1908		Dunnicliff, Horace Barratt, Prof., M.A. (Cantab.), B.Sc. (Lond.), Mohammedan Anglo-Oriental College, Aligarh, U.P., India
1909	Trans.	Dunningham, Alfred Charles, B.Sc. (Lond.), Church Cottage, Davenham, Northwich
1893		Dunnington, Francis Perry, University of Virginia, Charlottesville, U.S.A.
1899		Dunscombe, Frederick Charles, c/o Electric Reduction Co., Buckingham, Quebec, Canada
1901	Trans.	Dunstan, Albert Ernest, D.Sc. (Lond.), East Ham Technical College, East Ham, E.
1885		Dunstan, Malcolm James Rowley, M.A. (Oxon.), F.I.C., The College, Wye, Kent
1905		Dunstan, Sydney, The Royal Infirmary, Newcastle-on-Tyne
1879	Trans.	||Dunstan, Wyndham Rowland, Prof., C.M.G., Hon. M.A. (Oxon.), Hon. LL.D. (Aberd.), F.R.S., F.I.C., Imperial Institute, S.W.
1907		Dupré, Frederick Harold, St. Maur, Benhill Wood-road, Sutton, Surrey

C. 1888-
91
S. 1893-03
V. P.
1903-06

Date of Election.			
1907		Dupré, Percy Vivian, A.C.G.I., F.I.C., St. Maur, Benhill Wood-road, Sutton, Surrey	
1871		|| Durham, Henry, 13, Coleherne-road, South Kensington, S.W.	
1906		Durraus, Thomas Harold, B.Sc. (Lond.), 10, Titchfield-terrace, North-gate, Regent's Park, N.W.	
1883	Trans.	Durrant, Reginald Graham, M.A. (Oxon.), Rosetree, Marlborough	
1911		Dutt, Barum Chandra, Prof., M.A. (Calcutta), 172, Maniktola-street, Rambogan, Calcutta, India	
1908		Dutt, Bidhu Bhushan, Prof., M.A. (Calcutta), 62, Bakulbagan-road, Bhowanipore P.O., Calcutta, India	
1912	Trans.	Dutta, Jatindra Mohan, M.A. (Calcutta), Dacca College, Dacca, Eastern Bengal, India	
1892		Duxbury, Thomas, 17, Grosvenor-chambers, Deansgate, Manchester	
1909		Dyche-Teague, Francis Clifford, B.Sc. (Birm.), A.I.C., 28, King-street, Portman-square, W.	
1875	Trans.	{C.1893-7) (1904-08)	|| Dyer, Bernard, D.Sc. (Lond.), F.I.C., 17, Great Tower-street, E.C.
1890	Trans.		Dymond, Thomas Southall, F.I.C., Board of Education, South Kensington, S.W.
1912		Dyson, James Harry, 11, St. Ives-road, Skircoat Green, Halifax	
1883	Trans.	|| Dyson, Septimus, Nyddcombe, Warlingham, Whyteleafe, Surrey	
1905		Eade, Samuel George, 35, Blackborough-road, Reigate	
1908	Trans.	Eagles, Edwin Mortimer, M.A. (Cantab.), The Grammar School, Enfield, Middlesex	
1911		Eardley, James Furnival, Elmsdale, Broomhall-park, Sheffield	
1876		|| Earp, Francis Salisbury, Ph.D. (Giessen), F.I.C., 35, Porter-street, Kalgoorlie, W. Australia	
1907		Eastaugh, Frederick Alldis, A.R.S.M., The University, Sydney, N.S.W.	
1889	Trans.	|| Easterfield, Thomas Hill, Prof., M.A. (Cantab.), Ph.D. (Würzburg), F.I.C., Victoria University College, Wellington, New Zealand	
1891		Eastick, Charles E., Martineau's Refinery, King Edward-street, Whitechapel, E.	
1912		Eastick, Frederick Charles, B.A. (Cantab.), The Drive, South Woodford, N.E.	
1881		|| Eastick, John Joseph, A.R.S.M., F.I.C., 2, St. Dunstan's-hill, E.C.	
1908		Easton, Reginald Freeman, 38, Edith-road, West Kensington, W.	
1906		Eaton, Bertie James, F.I.C., Agricultural Dept., Kuala Lumpur, Selangor, Federated Malay States	

Date of
Election.

1878	Trans.	|| Eccles, Herbert, Briton Ferry Steel Works, Briton Ferry, Glamorganshire
1909		Edgar, Edward Charles, Keithack, Marple Bridge, Stockport
1909		Edge, Alfred, Ravenhurst, Clayton Bridge, Manchester
1909		|| Edge, John Harold, Great Marld, Smithills, Bolton
1903	Proc.	Edgerton, John Percy, St. Lawrence House, 96, Cheapside, E.C.
1902		Edlin, Edgar Leeder, B.A. (Oxon.), 36, Grant-road, Addiscombe, Croydon
1902	Trans.	Edminson, Sidney Robert, B.Sc. (Lond.), Preparatory School for Boys, Merchiston, Maritzburg, Natal, S. Africa
1913		Edmondson, James Henry, Newcroft, Meadows, Urmston, Manchester
1893		Edwards, Thomas, Ty Mawr, Rhymney, viâ Cardiff
1898		|| Edwards, Wilbraham Tollemache Arthur, M.R.A.C., F.I.C., Municipal Laboratory, Rose-hill, Mauritius
1909	Trans.	Egerton, Alfred Charles Glyn, B.Sc. (Lond.), Chilton House, Thame
1911		Eggington, Alfred Thomas, B.Sc. (Lond.), A.R.C.S., Borlase School, Marlow
1887		|| Ehrhardt, Ernest Francis, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), Badische Anilin und Soda Fabrik, Ludwigshafen-am-Rhein, Germany
1899		Eichenauer, William Frederick, 18, Maryon-road, Old Charlton, Kent
1911		Eldridge, Arthur Alfred, B.Sc. (Lond.), A.I.C., School House, Alpha-road, Surbiton, B.O., Surrey.
1903		Elford, Archibald Sefton, M.A. (Oxon.), 41, Broomfield-road, Chelmsford
1891		Elford, Percy, M.A. (Oxon.), 115, Woodstock-road, Oxford
1907		Elias, Owen Aubrey, 123, Waller-road, New Cross, S.E.
1878	Trans.	|| Elliott, Arthur Henry, Ph.D. (Columbia), The Chemists' Club, 52, East 41st-street, and The College of Pharmacy, 115, West 68th-street, New York City, U.S.A.
1913		Elliott, Thomas Lenton, Lincoln House, Heckmondwike, Yorks.
1893		Ellis, Charles Sordes, F.I.C., The Authors' Club, 2, Whitehall-court, S.W.
1900		Ellis, Frederic Richard, 28, Seymour-road, Ashley Down-road, Bristol
1903	Proc.	Ellis, Henry Russel, B.Sc. (Lond.), 34, Church-avenue, East Sheen, S.W.
1912		Ellis, Ridsdale, B.Sc. (Boston), c/o Messrs. Haseltine Lake & Co., 60, Wall-street, New York City, U.S.A.
1912		Ellis, Rowland Holliday, A.I.C., Lynwood, Thorpe-road, Selby
1878		Ellis, William Hodgson, Prof., M.A. (Cantab.), M.B. (Toronto), F.I.C., School of Practical Science, Toronto, Canada

Date of Election.		
1892	Trans.	Ellison, Henry, jun., Whitechapel-road, Cleckheaton
1893		Elmore, Alexander Stanley, 72, Gloucester-terrace, Hyde Park, W.
1902		Elsden, Alfred Vincent, B.Sc. (Lond.), F.I.C., Chemical Department, Royal Arsenal, Woolwich, S.E.
1912		Elsdon, George Davidson, B.Sc. (Birm.), A.I.C., City Analyst's Laboratory, Birmingham
1885	Trans.	Embrey, George, F.I.C., City and County Laboratory, 47, Park-road, Gloucester
1911		Emerson, Robert Leonard, A.B. and M.D. (Harvard), 739, Boylston-street, Boston, Mass., U.S.A.
1910		Emmett, William Gidley, M.A. (Cantab.), c/o The Japanese Explosives Co., Ltd., Hiratsuka, Japan, via Siberia
1887		|| Emmons, Hamilton, The Copse, Hamble, Southampton
1911	Trans.	Empson, Alfred Walker, A.M.I.E.E., A.M.I.Mech.E., 14, Scarcroft Hill, York
1910		Emslie, Benjamin Leslie, 1105, Temple-building, Toronto, Canada
1911		Enfield, Ralph Roscoe, B.A. and B.Sc. (Oxon.), Toynbee Hall, 28, Commercial-street, E.
1901		English, Robert, Christchurch Gas Co., Christchurch, New Zealand
1892		Entwistle, Herbert, Fairholme, Redelyffe-road, Palatine-road, Manchester
1899		Epps, James Washington, c/o Messrs. James Epps & Co., Ltd., Holland-street, Blackfriars, S.E.
1889		Erskine, James Kerr, New Kleinfontein Co., Ltd., Post Office, Benoni, Transvaal, S. Africa
1909		Essex, Harry, jun., 23, Bescot-street, Walsall
1862		|| Esson, William, Prof., M.A. (Oxon.), F.R.S., Merton College, Oxford
1865		|| Estcourt, Charles, F.I.C., Seymour House, Seymour-grove, Old Trafford, Manchester
1899		|| Estcourt, Harry Estcourt, 467, West-street, Durban, Natal, S. Africa
1888		|| Estcourt, Philip Anderson, F.I.C., Seymour House, Seymour-grove, Old Trafford, Manchester
1894		Eumorfopoulos, Nicholas, B.Sc. (Lond.), 24, Pembridge-gardens, W.
1904		Evans, Edward Victor, The Laboratory, South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1912		Evans, Elliott Alfred, College of Agriculture, Holmes Chapel, Cheshire
1891		Evans, Frederick Arthur, c/o Messrs. King & Co., 58, Toop-street, Cape Town, S. Africa

Date of
Election

1906		Evans, Frederick Watkins, Medical Hall, Cwmfelinfach, Newport, Mon.
1904		Evans, John, F.I.C., 67, Surrey-street, Sheffield
1892	Trans.	|| Evans, Robert Cecil Turle, M.B. and B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P., L.S.A., D.P.H. and B.Sc. (Lond.), Sandringham House, Marine-crescent, Herne Bay, Kent
1913		|| Evans, Ulick Richardson, B.A. (Cantab.), The Keir, The Common, Wimbledon, S.W.
1888		|| Everard, Arthur George, 43, Clapham-road, S.W.
1910	Trans.	Everest, Arthur Ernest, M.Sc. (Birm.), 3, Nottingham-road, Bishopston, Bristol
1908		Everitt, Charles, M.A. (Oxon.), 49, Latimer-road, Forest Gate, E.
1902		Everitt, Walter, Norwood Wharf, Southall, Middlesex
1894		Evershed, Frank, Kenley, Surrey
1896	Trans.	Ewan, Thomas, M.Sc. (Vict.), Ph.D. (Munich), c/o Cassel Cyanide Co., Ltd., Shuna-street, Maryhill, Glasgow
1909	Trans.	Ewins, Arthur James, B.Sc. (Lond.), 144, Ribblesdale-road, Streatham, S.W.
1902	Trans.	Eynon, Lewis, B.Sc. (Lond.), F.I.C., 4, Stag-lane, Buckhurst Hill, Essex.
1901	Trans.	Eyre, John Vargas, Ph.D. (Leipzig), South Eastern Agricultural College, Wye, Ashford
1888		Faber, Harald Nicolai, 7 and 8, Idol-lane, E.C.
1904		Fagan, Thomas Wallace, M.A. (Cantab.), Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1908		Fairburn, Henry, Eastside, Northallerton
1865	Trans.	|| Fairley, Thomas, F.I.C., 17, East-parade, Leeds
1895		Fairrie, Henry, 253, Vauxhall-road, Liverpool
1899		Fairweather, Ernest Barratt, King's College Hospital, Lincoln's Inn Fields, W.C.
1908		Fairweather, James Hill, 62, Wythes-road, Silvertown, E.
1908		Falk, Kaufman George, B.Sc. (Columbia), Ph.D. (Strassburg), 151, Central-park-west, New York City, U.S.A.
1888		Farlie, John Burke, 54, Wellington-road, Old Charlton, Kent
1912		Farlie, John Burke, jun., c/o British Post Office, Constantinople, Turkey
1906		Farmer, Charles George Edgar, 3, Brick-court, Temple, E.C.
1903	Trans.	Farmer, Robert Crosbie, D.Sc. (L'pool.), Ph.D. (Würzburg), Warbreck, Mount-road, Bexley Heath, Kent
1895		Farr, Edward Henry, Uckfield, Sussex
1870		|| Farries, Thomas, F.I.C., 16, Coleman-street, E.C.

Date of Election.		
1880		|| Farrington, Thomas, M.A. (Q.U.I.), F.I.C., 4, Waterloo-place, Cork
1907		Faweitt, Claude Scott, 11, St. Mark's-road, Bangalore, India
1887		Fawsitt, Charles Albert, 9, Foremount-terrace, Dowanhill, Glasgow
1903	Trans.	Fawsitt, Charles Edward, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), The University, Sydney, N.S.W.
1906	Proc.	Feilmann, Martin Ernest, B.Sc. (Lond.), Ph.D. (Bâle), F.I.C., 92, Victoria-street, S.W.
1897	Trans.	Fenby, Alarick Vincent Colpoys, B.Sc. (Lond.), 45, Culmstock-road, Clapham Common, S.W.
1878	Trans.	{ C. 1898- 1902 } || Fenton, Henry John Horstman, M.A. and Sc.D. (Cantab.), F.R.S., F.I.C., Christ's College, and 19, Brookside, Cambridge
1898		
		Ferguson, James Edward, Laboratory and Assay Office, 2, Union-court, Old Broad-street, E.C.
1872		C. 1889-99 || Ferguson, John, Prof., M.A. (Glas.), LL.D. (St. Andrews), F.I.C., The University, Glasgow
1912		
		Fergusson, Donald MacEachern, c/o Acadia Sugar Refining Co., Ltd., Halifax, Nova Scotia
1899		Fernor, Herbert Frederick Francis Burdett, 32, Trossacks-road, East Dulwich, S.E.
1909	Trans.	|| Ferraboschi, Frederic, M.A. (Cantab.), 21, Lawrie-park-road, Sydenham, S.E.
1902		Ferrand, Frederick, 13, Torrington-street, Hopwood, Heywood
1882		Ferrier, James, P.O. Box 764, Rome, Georgia, U.S.A.
1902		Ferris, Percy James, Norwood, Tower-road-south, Heswall, Heswall Hill, Birkenhead
1906		Field, Samuel, A.R.C.S., Northampton Polytechnic Institute, Clerkenwell, E.C.
1904		Field, William Eddington, Martin-street, Elsternwick, Melbourne, Australia
1911		Fielding, Michael Angelo, 2, Farleigh-place, Montenotte, Cork
1895		|| Fielding, Patrick Joseph Dominick, Rovigo, Victoria-road, Cork
1906	Trans.	Fierz, Hans Eduard, Ph.D. (Zürich), Farben-Extraetfabriken, vorm J. R. Geigy, Bâle, Switzerland
1900	Trans.	Findlay, Alexander, Prof., M.A. and D.Sc. (Aberd.), Ph.D. (Leipzig), F.I.C., University College of Wales, Aberystwyth
1908		Findley, Albert Edward, B.Sc. (Birm.), Dept. of Applied Science, The University, St. George's-square, Sheffield
1910		Finlayson, John George, B.A. (Cantab.), 13, Monarch-terrace, Blaydon-on-Tyne, Co. Durham
1904		Finlow, Robert Steel, B.Sc. (Wales), F.I.C., c/o Messrs. Grindlay and Co., Calcutta, India
1905	Trans.	Finmore, Horace, B.Sc. (Lond.), F.I.C., High Leasow, Heathhurst-road, Sanderstead, Croydon

Date of
Election.

1907		Fischer, Eugen, Ph.D. (Zürich), c/o Messrs. Kalle & Co., Aktiengesellschaft, Biebrich-am-Rhein, Germany
1896		Fisher, Ernest Hunter, The County Laboratory, St. Albans
1872	Trans.	|| Fisher, Walter William, M.A. (Oxon.), F.I.C., 5, St. Margaret's-road, Oxford
1873		Fison, Edward Herbert, Stoke House, Ipswich
1872		Fison, Sir Frederick William, Bart., M.A. (Oxon.), Boarzell, Hurst Green, Etchingham, Sussex
1906		Fitzgerald, Anthony Nisbet, B.A. and B.Sc. (Lond.), 1, King's-parade, Muswell Hill, N.
1896		Fleet, John Thomas, 24, Sheep-street, Rugby
1912		Fleet, Wilfrid James, Toynton, Felixstowe, Suffolk
1899	Trans.	|| Fleischmann, Friedrich Noël Asheroft, M.A. (Oxon.), 37, Palace-court, Bayswater, W.
1898		|| Fleming, John Arnold, Woodburn, Rutherglen, Glasgow
1874		Fletcher, Frederick William, North London Chemical Works, Holloway, N. ; and Beauchamp Lodge, Enfield
1885	C. 1893-4	|| Fletcher, Lazarus, M.A. (Oxon.), F.R.S., Natural History Department, British Museum, Cromwell-road, S.W. ; and 35, Woodville-gardens, Ealing, W.
1894		|| Flintoff, Robert John, Haxby, York
1892		Floris, Robert Brooke, F.I.C., Heathwood, Woodside-road, Beaconsfield, Bucks.
1906	Trans.	Flürscheim, Bernhard, Ph.D. (Heidelberg), Rushmoor, Fleet, Hants.
1894		Fogg, Charles Albert, Graythorne, Albert-road, Bolton
1859		Fogg, Thomas, 93, Portsdown-road, Maida Vale, W.
1889		Foggie, John, University College, Dundee
1902		Foll, Edgar, The Cottage, The Lion Brewery, Belvedere-road, Lambeth, S.E.
1885		Follows, Harold, 5, Kedleston-avenue, Victoria-park, Manchester
1894		|| Forbes, Donald Gordon, Union Club, Victoria, British Columbia
1889	Trans.	Ford, John Simpson, c/o Messrs. W. Younger and Co., Abbey Brewery, Edinburgh
1907		Foreman, Charles Thomas, Jamalpur, East Indian Railway, Bengal, India
1886		Formoy, James Arthur, Chestham, Grange-road, Sutton, Surrey
1904		Forrest, John Kerr, 271, Carlisle-street, St. Kilda, Victoria, Australia
1909		Forrester, George Peters, 69, Beckstrasse, Darmstadt, Germany
1909		Forshaw, Arthur, M.Sc. (Manc.), Essex Works, Aston, Birmingham
1910	Trans.	Forster, Aquila, B.Sc. (Dun.), Armstrong College, Newcastle-on-Tyne

Date of Election		
1905		Forster, Ernest Lyle Carman, M.A. (Toronto), 317, Queen-street, Ottawa, Canada
1892	Trans.	|| Forster, Martin Onslow, D.Sc. (Lond.), Ph.D. (Würzburg), F.R.S., F.I.C., Royal College of Science, South Kensington, S.W.; and 84, Cornwall-gardens, South Kensington, S.W.
1903		Forster, William, 30, Church-street, Seaham Harbour
1912		Foster, Alfred George Ernest, 103, St. Mark's-road, Bristol
1856	Trans.	|| Foster, George Carey, Prof., B.A. (Lond.), LL.D. (Glas.), D.Sc. (Vict.), F.R.S., Emeritus Professor of Physics, University College, Gower-street, W.C.; and Ladywalk, Rickmansworth, Herts.
1872		Foster, Reginald Le Neve, Fulshaw Cottage, Wilmslow, Manchester
1906		Foucar, James Louis, B.Sc. (Lond.), 15, Morden-road, Blackheath, S.E.
1900		Foulds, James, A.R.C.S., 2, Radfield-road, Darwen
1898		Foulerton, Alexander Grant Russell, F.R.C.S. (Eng.), L.R.C.P., (Lond.), D.P.H. (Cantab.), 1, Morpeth-terrace, Victoria-street, S.W.
1891	Trans.	|| Fowler, Gilbert John, D.Sc. (Vict.), F.I.C., Rufford, Dickenson-road, Rusholme, Manchester
1900		Fowler, Morris Broad, 19, Westbury-road, Westbury-on-Trym, near Bristol
1882		|| Fowler, William, 78, Melton-terrace, New Hartley, Seaton Delaval, Northumberland
1909		Fowler, William, Glenwood, Bearsden, Glasgow
1907		Fowles, George, B.Sc. (Lond.), 79, Speldhurst-road, Bedford Park, W.
1895		Fox, Albert Stanley, Uplees, Faversham
1907	Trans.	Fox, John Jacob, D.Sc. (Lond.), 6, Alkham-road, Stamford Hill, N.
1907		Foxell, Edward William Lanchester, B.Sc. (Lond.), Barnes, Christ's Hospital, West Horsham, Sussex
1906		Foy, Peter Bertram, 16, Burlington-road, Dublin
1909	Trans.	Francis, Arthur Gordon, B.Sc. (Lond.), F.I.C., The Government Laboratory, Clement's Inn Passage, Strand, W.C.
1879		Francis, Edward, Clifton-lane, Ruddington, Nottingham
1902	Trans.	Francis, Francis Ernest, Prof., D.Sc. (Vict.), Ph.D. (Erlangen), F.I.C., University College, Bristol
1873		|| Francis, George Bult, 22-30, Graham-street, City-road, N.
1912	Trans.	Frankland, Edward Percy, B.A. (Cantab.), Ph.D. (Würzburg), M.Sc. (Birm.), The Dell, Northfield, Birmingham
1881		Frankland, Henry, F.I.C., Streoushalh, The Crescent, Linthorpe, Middlesbro'.

Date of
Election.

1880	Trans.	<div> <div>C.</div> <div>1887-9</div> <div>V.P.</div> <div>1902-</div> <div>05.</div> <div>P.</div> <div>1911-</div> <div>13.</div> </div>	|| Frankland, Percy Faraday, Prof., Hon. LL.D. (St. Andrews), Hon.Sc.D. (Dub.), Ph.D. (Würzburg), Hon. M.Sc. (Birm.), B.Sc. (Lond.), A.R.S.M., F.R.S., F.I.C., The University, Edgbaston, Birmingham ; and The Dell, Northfield, Birmingham
			|| Fraser, James Christopher, Austin-street, Adelaide, S. Australia
			Freear, Harry Marshall, Ampthill
			Freeman, Frederick William, Heatherdale, Spenser-road, Harpenden, Herts.
			Freeman, Horace, c/o Dominion of Canada Assay Office, P.O. Box 804, Vancouver, British Columbia
1890			Freeman, Willie Ludford, M.A. (Oxon. and Dub.), LL.D. (Dub.), The Education Offices, Stoke-on-Trent
1889			Freestone, Joseph Thomas, Linnehurst, Plymyard-avenue, Bromboro', Birkenhead
1892	Proc.		French, William, M.A. (Cantab.), F.I.C., Meadowside, Lancaster
1909			Freyrnuth, William Adolf, Umaria, Rewa State, Central India
1903	Trans.		Friend, John Albert Newton, D.Sc. (Birm.), Ph.D. (Würzburg), The Victoria Institute, Sansome-walk, Worcester
1890			|| Frost, Robert, B.Sc. (Lond. and Viet.), 55, Kensington-court, Kensington, W.
1904			|| Fry, George, Carlin Brae, Berwick-on-Tweed
1899	Trans.		Frye, Colin Charlwood, F.I.C., 18, Woodfield-road, Ealing, W.
1880			|| Fryer, Alfred Cooper, M.A. and Ph.D. (Leipzig), F.I.C., 13, Eaton-crescent, Clifton, Bristol
1907			Fryer, Percival John, 45, Burnaby-gardens, Grove-park, Chiswick, W.
1909			Fürstenhagen, Otto, c/o Aktien-Gesellschaft für Anilinfabrikation, Berlin, S.O. 36, Germany
1891			Fulcher, Lionel William, B.Sc. (Lond.), Victoria and Albert Museum, S.W. ; and Ingleside, 37, Kempshott-road, Streatham Common, S.W.
1896			Fuller, Charles James Pemeller, 603, Chorley-new-road, Horwich, near Bolton, Lanes.
1909			Furneaux, George Pomeroy, B.A. (Oxon.), 8, Mount Pleasant-crescent, Hastings
1894			|| Gabb, George Hugh, 83, Crayford-road, Tufnell Park, N.
1899			Gabriel, Edmund Vivian, C.S.I., C.V.O., M.A. (Cantab.), Babbacombe Glen, Babbacombe, Torquay
1901			Gadd, Henry Wippell, Barrister-at-Law, Common Room, Middle Temple, E.C. ; and 27, East Southernhay, Exeter

Date of
Election.

1912		Gadd, Sydney Charles, 23, Velwell-road, Exeter
1912		Gajjar, Madanlal Jekisandas, M.A. (Bombay), Techno-Chemical Laboratory, Girgaum, Bombay, India.
1901		||Gajjar, Tribhuvandas Kalyandas, Prof., M.A. and B.Sc. (Bombay), Girgaum, Bombay, India
1908		Gale, Robert Cecil, A.C.G.I., 38, Scarsdale-villas, Kensington, W.
1907		Gall, John Beaconsfield, A.C.G.I., F.I.C., 49, Glenlyon-road, Eltham Park, Kent
1912		Gallogly, Michael Francis, Rev. Prof., B.A. (R.U.I.), St. Colman's College, Newry
1911		Gallsworthy, Benjamin, c/o The Gulf Refinery Co., Port Arthur, Texas, U.S.A.
1903		Gandy, William Hunter, Bradley Court, Mitcheldean, Gloucester
1908	Trans.	Ganguli, Atul Chandra, Prof., B.A. (Calcutta), Ravenshaw College, Cuttack, Orissa, India
1912		Garbutt, Cornelius Durham, 2, Hartington-road, Garston, Liverpool
1883	Proc.	||Garbutt, Llewellyn, M.A. (Cantab.), The College, Winchester
1909		||Gardiner, Alexander David, 6, Wellfield-terrace, Springburn, Glasgow
1888		Gardiner, James Henry, 59, Wroughton-road, Balham, S.W.
1905		Gardner, Charles Richard, Chemical Laboratory, Gathurst, near Wigan
1911		Gardner, Edgar Harold, 34, Salisbury-avenue, Colchester
1906		Gardner, Edward, Bigwood-road, Meadway, Hendon, N.W.
1909	Trans.	||Gardner, Henry Dent, M.Sc. (Manc.), 46, The Goffs, Eastbourne
1901		Gardner, Hermann Charles Thomas, Miller Hospital and Royal Kent Dispensary, Greenwich-road, S.E.
1893	Trans.	Gardner, John Addyman, M.A. (Oxon.), F.I.C., Chemical Department, St. George's Hospital, S.W.
1888	Trans.	Gardner, Walter Myers, Prof., M.Sc. (Leeds), Technical College, Bradford; and 3, Fairmount, Manningham, Bradford
1911		Gardner, William Temple, Bruern, Alexandra-road, Upper Parkstone, Dorset
1911		Gardthausen, Charles Christian, P.O. Box 80, Mines Dept., Geological Survey Office, Pretoria, Transvaal, S. Africa
1910	Trans.	Garland, Charles Samuel, B.Sc. (Lond.), A.R.C.S., A.I.C., 57, Garratt-lane, Wandsworth, S.W.
1913		Garland, Herbert, P.O. Box 417, Cairo, Egypt
1902		Garle, John Longsdon, F.I.C., 136, Holland-road, Kensington, W.
1911		Garner, John Henry, B.Sc. (Lond.), Sewage Works, Deighton, Huddersfield
1893	Trans.	Garnett, Henry, 309, Oxford-road, Manchester

Date of
Election.

1913		Garrett, Albert Edward, B.Sc. (Lond.), c/o Dr. Jaeger's Co., Ltd., 95, Milton-street, E.C.
1889	Trans.	Garrett, Frederic Charles, D.Sc. (Vict.), 27, Fern-avenue, Newcastle-on-Tyne
1898		Garside, Arthur Leonard Harry, c/o Dr. A. K. Miller, F.I.C., 19, Kilvert's-Buildings, Withy-grove, Manchester
1906		Garvey, Richard Godfrey Hamilton, Newnes, via Wallerawang, N.S.W.
1884		Gaskell, Joseph, 71, Haworth's-buildings, Cross-street, Manchester
1900		Gasson, William, Dutoitspan-road, Kimberley, S. Africa
1903		Gatehouse, Frank Brooks, Maristowe, Butts Green-road, Hornchurch, Romford
1911	Trans.	Gauge, Arthur Josiah Hoffmeister, 2, Ashford-avenue, Hornsey, N.
1912		Gaul, Ernest George, M.Sc. (Manc.), The College, Holmes Chapel, Cheshire
1911		Gaunt, Rufus, M.Sc. (Leeds), Ph.D. (Berlin), Imperial Institute, S.W.
1904	Trans.	Gawler, Robert, M.Sc. (Vict.), F.I.C., Technical School, Dewsbury
1887		Geisler, Joseph Frank, Mercantile Exchange Buildings, Hudson and Harrison-streets, New York City, U.S.A.
1885		Gemmell, George Harrison, F.I.C., 4, Lindsay-place, Edinburgh
1903		Gent, Percy William, Trentholme, Misterton, Gainsboro'
1879		||Gent, William Thomas, Misterton, Gainsboro'
1896		George, George, F.I.C., Director of Technical Instruction, Auckland, New Zealand
1889		||Gerland, Conrad, M.Sc. (Vict.), Ph.D. (Marburg), Meadow Bank, Accrington
1891		German, George, jun., Mansion House, Ashby-de-la-Zouch
1895		||Gerrans, Henry Tresawna, M.A. (Oxon.), 20, St. John-street, Oxford
1875		Gerrard, Alfred William, Southmead, St. Agnes-road, Moseley, Birmingham
1899		Getman, Frederick Hutton, Ph.D. (Johus Hopkins), Dalton Hall, Bryn Mawr College, Bryn Mawr, Penn., U.S.A.
1904		Ghose, Anu, 42, Shambazar-street, Calcutta, India
1911		Ghose, Joges Chandra, Prof., M.A. (Calcutta), Jagannath College, Dacca, Bengal, India
1913		Ghose, Tin Kari, B.A. and L.M.S. (Calcutta), 23/1, Baniatola-street, Hatkhola P.O., Calcutta, India
1912		Ghosh, Jyotish Chandra, B.Sc. (Manc.), Gov't. Medical Stores, Mint Buildings, Madras, India
1890		||Gibbes, Cuthbert Chapman, M.D. and C.M. (Aberd.), M.R.C.P. (Lond.), D.P.H. (Cantab.), 23, New Cavendish-street, W.

Date of
Election

1900		Gibbings, George William, Standard Bank of South Africa, Salisbury, Rhodesia, S. Africa
1912		Gibbins, Richard Ernest, 49, Park-road, Coventry
1897		Gibbons, Joseph Lake, Secondary School, Blyth, Northumberland
1907	Trans.	Gibson, Charles Stanley, Prof., M.A. (Oxon. and Cantab.), B.Sc. (Oxon.), M.Sc. (Manc.), The Maharaja's College, Trivandrum, Travancore, S. India
1900		Gibson, John, 15, Tynedale-terrace, Hexham
1892	Trans.	Gibson, John, Prof., Ph.D. (Heidelberg), F.R.S.E., F.I.C., Heriot Watt College, Edinburgh
1907		Gibson, William Howieson, B.Sc. (Lond.), 23A, Wellington-road, Old Charlton, Kent
1888		Gibson, William Humphrey, 122, King's-road, Brighton
1911		Giddy, Thomas Grantham, Blackall-street, Hamilton, N.S.W.
1895		Gilbard, John Francis Hutchins, F.I.C., 245, Dalston-lane, Hackney, N.E.
1904		Gilchrist, James Gray, M.A. (Aberd.), B.Sc. (Lond.), Blythswood, Victoria-road, Annan
1898		Gilderdale, Frederick, 32, Treherne-road, High West Jesmond, Newcastle-on-Tyne
1883		|| Gill, Ernest Clarendon, 10, Barrack-road, Christchurch, Hants.
1888		Gill, John, Gwealhellis, Helston, Cornwall
1902		Gill, J. Arthur, Pennsylvania, Lower-green-road, Rusthall, Tunbridge Wells
1898	Proc.	Gilles, William Setten, A.C.G.I., F.I.C., The Cottage, Bocking, Braintree, Essex
1908	Trans.	|| Gilling, Charles, B.Sc. (Lond.), A.I.C., Station-parade, Sunningdale, Ascot
1901		Gillman, Edward, Government Laboratory, Barbados, West Indies
1913	Trans.	Gilmour, Robert, Ph.D. (Würzburg), B.Sc. (St. Andrews), Scores Villa West, St. Andrews
1897		Girtin, Thomas, M.A. (Cantab.), c/o H. L. Raphael's Refinery, Thomas-street, Burdett-road, Limehouse, E.
1908	Proc.	Girvan, Arthur Frank, B.Sc. (Lond.), 117, Thurlow Park-road, West Dulwich, S.E.
1898		Glaister, John, Prof., M.D. (Glas.), M.R.C.S. and L.R.C.P. (Edin.), 18, Woodside-place, Glasgow
1907		Gledhill, Walter George, M.A. (Cantab.), The School House, Woodbridge
1912		Glegg, Robert, B.Sc. (Aberd.), F.I.C., 19, Mount-street, Aberdeen
1913		Glenday, Roy Gonçalves, B.A. (Cantab.), Emmanuel College, Cambridge
1872		|| Glover, George Thomas, F.I.C., 23, Craven-hill-gardens, Lancaster Gate, W.

Date of
Election.

1904		Glover, Harry James, St. Katharine's, Westham, Pevensey, Hastings
1906	Trans.	Glover, Walter Hannis, Ph.D. (Leipzig), Flamsted, The Avenue, Braintree
1907	Trans.	Godden, William, B.Sc. (Lond.), A.R.C.S., F.I.C., Agricultural Department, The University, Leeds
1910		Goddon, George Alexander, 18, Rylett-crescent, Shepherd's Bush, W.
1899		Golding, John, F.I.C., University College, Reading
1910		Goldsbrough, Harold Albert, A.I.C., 45, Streatham Hill, S.W.
1878		||Goldschmidt, Samuel Anthony, A.M. (C.C.N.Y.), E.M. (Columbia), Ph.D. (Emory Coll.), 11, Broadway, New York City, U.S.A.
1889		Goldsmith, Byron B., Ph.B. (Columbia), 19, East 74th-street, New York City, U.S.A.
1898		Goldsmith, John Naish, B.Sc. (Vict.), Ph.D. (Heidelberg), 67, Chancery-lane, W.C.
1899		Goltz, Harold Francis Carl, 63, Endymion-road, Brixton Hill, S.W.
1897		Gomess, Alfred Francis Bilderbeck, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 33, Drayton-gardens, South Kensington, S.W.
1911		Gonville, Cyril Herbert Koszelski, 63, The Broadway, Stratford, E.
1904		||Goodson, John Augustus, F.I.C., 19, Darnley-road, Hackney, N.E.
1896	Trans.	Goodwin, William, M.Sc. (Manc.), Ph.D. (Göttingen), The Midland Agricultural and Dairy College, Kingston, Derby
1911		Goold, Rowland Lewis, Assoc.I.E.E., 5, Corporation-street, Birmingham.
1875		Gordon, Joseph Gordon, F.I.C., Queen Anne's-mansions, Westminster, S.W.
1905		Gorman, Henry Isaac, 126, Quay, Waterford, Ireland
1909	Trans.	Gortner, Ross Aiken, M.A. (Toronto), B.Sc. (Nebraska), Ph.D. (Columbia), Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbour, Long Island, N.Y., U.S.A.
1890		Gossling, Frank, B.Sc. (Lond.), H.M. Patent Office, Staple Inn, W.C.
1889	Trans.	||Gott, Benjamin Scaife, M.A. (Cantab.), Middlesex Education Committee, Queen Anne's-chambers, 28, Broadway, Westminster, S.W.
1897	Trans.	||Goulding, Ernest, D.Sc. (Lond.), F.I.C., 88, Sylvan-avenue, Chitts Hill, N.
1887		Gover, Herbert James, 29, Piccadilly, Hanley, Staffs.
1889		Gow, Robert John, Ivy Lea, Hough Green, near Widnes

Date of Election.		
1893		Gower, Alfred Roland, Ashleigh, Furness-park-road, Barrow
1871	Trans.	(C. 1898- [01, 1906-7]) ||Gowland, William, Prof., A.R.S.M., F.R.S., F.I.C., 13, Russell-road, Kensington, W.
1887	Trans.	
		Goyder, George Arthur, 110, Gawler-place, Adelaide, S. Australia
1880	Trans.	||Graham, Christopher Colborne, F.I.C., Oriel House, Scarborough
1910		Gramont, Count Arnaud de, D. ès Sc., Membre de l'Institut de France, 179, Rue de l'Université, Paris, France
1890	Trans.	Grant, James, M.Sc. (Manc.), F.I.C., Oaklands, Gardner-road, Prestwich, near Manchester
1887		Gravill, Edward Day, 42, Walmsley-street, Hull
1882		||Gray, George, Canterbury Agricultural College, Lincoln, New Zealand
1913		Gray, George Watson, F.I.C., 8, Inner Temple, Liverpool
1912		Gray, Harold Heath, B.Sc. (Manc.), Birdwell Common, Birdwell, Barnsley
1900	Trans.	Gray, Robert Whytlaw, Ph.D. (Bonn), University College, Gower-street, W.C.
1892	Trans.	||Gray, Thomas, Prof., D.Sc. (Glas.), Ph.D. (Jena), The Technical College, Glasgow
1895		Greaves, William Abraham, B.Sc. (Lond.), 23A, Broad-bank, Louth, Lincs.
1885	Trans.	C. 1894-5 ||Green, Arthur George, Prof., Hon. M.Sc. (Vict.), F.I.C., The University, Leeds; and 49, Cardigan-road, Headingley, Leeds
1902	Trans.	
		Green, Clarence James, B.Sc. (Vict.), c/o Messrs. Nicholson and Co., Beaumont Works, St. Albans
1905		Green, Ernest, 98, Cheadle-road, Cheadle Hulme, Stockport
1908		Green, Henry Hamilton, B.Sc. (Glas.), 36, Princes-square, Regent-park, Glasgow
1878		Green, Herbert, Hayle Mill, Maidstone
1887		Green, John Edward, A.R.S.M., F.I.C., West Clyne, Stretford, Manchester
1909		Green, John Wilberforce, 96, Devonshire-road, Forest Hill, S.E.
1878		Green, Lawrence, Lower Tovil, Maidstone
1908		Green, Leonard Clifford, B.E. (Sydney), Wienholt-street, Torwood, Brisbane, Queensland
1907		Green, William Heber, D.Sc. (Melbourne), The University, Melbourne, Australia
1874	Trans.	||Greenaway, Alfred John, F.I.C., The Orchard, Chertsey, Surrey
1907		
		Greenough, Thomas Rigby, B.A. (Cantab.), F.I.C., Beechwood, Leigh, Lancs.
1885		Greenway, Thomas John, F.I.C., 369, Collins-street, Melbourne, Australia

Date of
Election

1894 Proc.

1891

1907

1906 Trans.

1896

1907

1910

1908

1888

1911

1905

1902

1902

1893

1906

1889

1909

1900

1895

1871 Trans.

1905

1906

1897

1912

||Greeves, Alfred, B.Sc. (Lond.), A.R.C.S., A.I.C., 25, Balmuir-gardens, Putney, S.W.

Gregory, Alfred John, M.D. and B.Sc. (Dun.), M.D. (Cape of Good Hope), M.R.C.S. and D.P.H. (Eng.), 69, Parliament-street, Cape Town, S. Africa

Gregory, Joshua Craven, B.Sc. (Lond.), F.I.C., 128, Wellington-street, Glasgow

Gregory, Thomas William Diggle, Kinross, Trentham, Stoke-on-Trent

Grice, Walter Thomas, 9, Dalhousie-square, Calcutta, India

Grieb, Christopher Maurice Walter, B.Sc. (Lond.), F.I.C., c/o Nobel's Explosives Co., Ltd., Polmont Station

Grieve, James, 1, Albemarle-road, Beckenham

Griffin, John, B.A. (Cantab.), St. John's College, Battersea, S.W.

||Griffith, David Agnew, Silver Leigh, Poll Hill-road, Heswall, Heswall Hill, Birkenhead

Griffiths, Evan Dalton, B.Sc. (Wales), East Ham Technical College, East Ham, E.

Griffiths, John, B.Sc. (Wales), The Grammar School, Larne, Ireland

Griffiths, John Thomas, B.Sc. (Lond.), Green-hill, Tenby, S. Wales

Grimwade, Wilfrid Russell, B.Sc. (Melbourne), 342-346, Little Flinders-street, Melbourne, Australia

Grimwood, Robert George, F.I.C., 43, Leaside-avenue, Muswell Hill, N.

Grindley, Harry Sands, Prof., D.Sc. (Harvard), B.Sc. (Illinois), State University, Urbana, Ill., U.S.A.

Gripper, Harold, Chapel-lane, Wilmslow, Cheshire

Grist, Charles James, Elgin House, Knockholt, Sevenoaks

Gritton, Henry Bertie, The Royal Mint, Sydney, N.S.W.

Grossmann, Edward Henry, 8, Onslow-place, South Kensington, S.W.

||Groves, Charles Edward, F.R.S., F.I.C., Kennington Green, S.E.

Groves, Samuel Ernest, 3, Ripon-gardens, Jesmond, Newcastle-on-Tyne

Grubb, David Paton, B.Sc. and B.Sc. Eng. (Edin.), A.R.S.M., 17, Victoria-road, Barnsley

Grundey, Frederick Roscoe, B.Sc. (Vict.), Edale, Albany-road, Douglas, Isle of Man

Grützmacher, Frederick Lyle, The Armidale School, Armidale, N.S.W., Australia

(C. 1877-8
1909-12
V.P.
1899-02)

Date of
Election.

1910		Guhlmann, Charles Frederick, Grantwood, Bergen Co., N.J., U.S.A.
1902		Gumersall, Edward, 34, Freegrove-road, N.
1895		Gunn, Alexander, 5, Leppoe-road, Clapham Park, S.W.
1906		Gupta, Hem Chandra Dutt, Prof., M.A. (Calcutta), Gupta-Nibas, Krishnagar, Dist. Nadia, Bengal, India
1888	Trans.	Guthrie, Frederick Bickell, F.I.C., Chemical Laboratory, Department of Agriculture, Sydney, N.S.W.
1904	Trans.	Guthrie, John Monteath, 199, Ferry-road, Leith
1904	Trans.	Guttmann, Leo Frank, Ph.D. (Heidelberg), A.C.G.I., F.I.C., Queen's University, Kingston, Ontario, Canada
1902	Trans.	Haas, Paul, D.Sc. (Lond.), Ph.D. (Freiburg), 11, Westbourne-park-road, W.
1913		Haber, Fritz, Prof., Post Lichterfelde 3, Berlin-Dahlem, Germany
1910	Trans.	Hackford, John Edward, B.Sc. (Lond.), A.I.C., Compania Mexicano de Petroleo "El Aguila," The Refinery, Minatillam, Ver., Mexico
1894		Hadley, Arthur, c/o Messrs. Georges Brewery, Ltd., Bristol
1893		Hadley, Henry Edwin, B.Sc. (Lond.), A.R.C.S., School of Science, Kidderminster
1886	Trans.	Haga, Tanemasa, Prof., D.Sc. (Japan), College of Science, University of Tokio, Tokio, Japan
1881		Hailes, Alfred James de, F.I.C., 15, Red Lion-square, W.C.
1912		Haines, Thomas Sidney, A.I.C., 73, Kennington-avenue, Bristol
1892		Haines, Walter Stanley, Prof., c/o Rush Medical College, Chicago, Ill., U.S.A.
1876	Trans.	Hake, Henry Wilson, Ph.D. (Giessen), F.I.C., Westminster Hospital Medical School, Caxton-street, S.W.
1912		Hale, Arthur James, B.Sc. (Lond.), A.I.C., 53, Gowrie-road, Lavender Hill, S.W.
1893		Hale, Henry Ormsby, M.A. (Cantab.), Oundle School, Oundle
1891	Trans.	Hall, Alfred Daniel, M.A. (Oxon.), F.R.S., The Development Commission, Queen Anne's-chambers, S.W.
1889		Hall, Allan Twistleton, c/o Messrs. Sissons Bros. and Co., Ltd., Hull
1891		Hall, Archibald, F.I.C., 7, Fenehurch-avenue, E.C.
1911		Hall, Arthur Bennett, 21, Union-street, Bath
1889	Trans.	Hall, John Albert, Lieut.-Col., M.Sc. (Manc.), Longstone, Esquimault-road, Victoria, British Columbia
1903		Hall, John Thomas, West View, Stanwell, Staines

Date of
Election.

1906		Hall, Octavius, L.R.C.P. and L.R.C.S. (Edin.), L.F.P.S. (Glas.), D.P.H. (R.C.P.S.I.), 7, Albemarle-villas, Devonport
1899		Hall, Samuel Godfrey, c/o Messrs. Edward Cook & Co., Works, Bow, E.
1911		Hall, Sydney, B.Sc. (Manc.), The Grammar School, Alcester, Warwickshire
1908		Hall, William, B.Sc. (Viet.), Municipal Technical School, The Newarke, Leicester.
1886		Halliburton, William Dobinson, Prof., M.D., B.Sc. and F.R.C.P. (Lond.), M.R.C.S., (Eng.), F.R.S., Church Cottage, 17, Marylebone-road, N.W.
1897		Halliwell, Edward, F.I.C., c/o Ribble Joint Committee, 2, Stanley-place, Preston
1902		Hallowell, Thomas Butterworth, Wood Cottage, Middleton, Manchester
1900		Halstead, Reginald Gordon, 12 and 16, Coleman-street, E.C.
1888	Trans.	Hamilton, James Cullen, Barrows-green, near Kendal, Westmoreland
1898		Hamilton, Oswald, Old Stratford, Stony Stratford, Bucks.
1875	Trans.	Hamlet, William Mogford, F.I.C., Department of Public Health, Sydney, N.S.W.
1904		Hammond, Harold Sankey, Macdonald College, St. Anne de Bellevue, Quebec, Canada
1901		Hammond, Herbert Blackmore, 101, Barton-road, Dover
1911	Trans.	Hampshire, Charles Herbert, B.Sc. (Lond.), 17, Bloomsbury-square, W.C.
1857		Hanbury, Cornelius, F.I.C., Plough-court, Lombard-street, E.C.; and Manor House, Little Berkhamsted, Hertford
1900		Handcock, Walter Augustus, F.I.C., Pentlands, 39, The Avenue, Beckenham, Kent
1910		Handley, John, Box 124, Sudbury, Ontario, Canada
1895	Trans.	Hanes, Edgar Septimus, F.I.C., 34, Sarre-road, West Hampstead, N.W.
1910		Hanley, John, F.I.C., 7, University-road, Bootle, Liverpool
1872	Trans.	Hannay, James Ballantyne, F.I.C., Cove Castle, Loch Long
1889		Hanson, Alfred Miall, The Marjorie, Whalley, Blackburn
1901	Trans.	Hanson, Edward Kenneth, M.A. (Cantab.), F.I.C., Woodthorpe, Royston-park-road, Hatch End, Middlesex; and 2A, The Parade, High-street, Watford
1906		Hanson, Harold Norman, Field Head, Brighouse, Yorks.
1895		Hanson, Weldon, Westwick, Ashville-avenue, Norton, Stockton-on-Tees
1897		Harbord, Frank William, A.R.S.M., F.I.C., Surbiton House, Englefield Green, Surrey

Date of Election.			
1859	Trans.	{S. 1865-73 V.P. 73-6, 80-8, 92-5 P. 1895-7	|| Harcourt, Augustus George Vernon, M.A. and Hon. D.Sc. (Oxon.), Hon. D.C.L. (Dun.), Hon. LL.D. (Montreal), F.R.S., F.I.C., St. Clare, Ryde, Isle of Wight
1887	Trans.	{C. 1902-1 (05, 1912-}	|| Harden, Arthur, D.Sc. (Vict.), Ph.D. (Erlangen), F.R.S., F.I.C., 5, Cambridge gardens, Marlborough-road, Richmond, Surrey
1911			Harding, Henry George Alan, Darling-street, Chatswood Sydney, N.S.W.
1901			Harding, Herbert, B.Sc. (Lond.), 54, Streathbourne-road, Upper Tooting, S.W.
1912			Harding, Leonard, Fern Lea, Russell-street, Eccles
1909	Trans.		Harding, Victor John, D.Sc. (Manc.), McGill University, Montreal, Canada
1892			Hardy, James Gordon, c/o The Creston Colorado Mining Co., Torres Sonora, Mexico
1909			Hargreaves, Egerton, M.Sc. (Manc.), Arthog, Garner's-lane, Davenport, Stockport
1876			Hargreaves, James, 32, Sayce-street, Widnes
1884			Hargreaves, John, F.I.C., Widnes
1900			Hargreaves, William Arthur, M.A. and B.C.E. (Melbourne), F.I.C., Globe-chambers, Victoria-square-west, Adelaide, S. Australia
1900			Harker, George, D.Sc. (Lond.), 35, Boulevard, Petersham, Sydney, N.S.W.
1909			Harland, Robert Main, A.R.S.M., 37, Lombard-street, E.C.
1878			|| Harland, William Dugdale, 48, King-street, Manchester
1897			|| Harley, Vaughan Berkeley, Prof., M.D. (Edin.), M.R.C.P. (Lond.), 25, Harley-street, W.
1897			Harman, Harold Wallis, 24, Holborn-viaduct, E.C.
1903			Harmer, Francis Gerald, Cockburn High School, Leeds
1899			Harper, Henry Winston, M.D. (Virginia), The University of Texas, and 2216, Rio Grande-street, Austin, Texas, U.S.A.
1907			Harrington, Arthur George, F.I.C., Municipal Buildings, Singapore, Straits Settlements
1881			Harrington, William Bury, Leevue, Montenotte, Cork
1896			Harris, Frederick William, F.I.C., 26, John-street, Glasgow
1893			Harris, Harold, The Birmingham Metals and Munitions Co., Ltd., Ammunition Factory, Streetly, nr. Sutton Coldfield, Birmingham
1895			Harris, Harry, A.R.S.M., c/o The Tasmanian Smelting Co., Ltd., Zeehan, Tasmania
1878			|| Harris, Thomas Frederick, B.Sc. (Lond.), 89, Bouverie-road-west, Folkestone
1894	Trans.		Harrison, Edward Frank, B.Sc. (Lond.), F.I.C., 55, Chancery-lane, W.C. ; and Langholm, Edgar-road, S. Croydon

Date of
Election.

1910		Harrison, Edwin, Hillside, Dudding Hill-lane, Neasden, N.W.
1888		Harrison, John Burchmore, C.M.G., M.A. (Cantab.), F.I.C., Government Laboratory, Georgetown, Demerara, British Guiana
1902		Harrison, Walter Ernest, 17, Soho-road, Handsworth, Birmingham
1901		Harry, Frederick Thomas, 3, Deauville-court, Clapham Park, S.W.
1886		Hart, Bertram Harvey, Rosslyn, High-street, Sidcup, Kent
1900		Hart, Herbert William, Winthrop, Ansdell-road, Lytham
1891		Hart, William Beaumont, F.I.C., Laboratory, 8, Exchange-street, Manchester
1882		Hartley, Arthur, The Brewery, Emsworth, Hants.
1897	Trans.	Hartley, Ernald George Justinian, B.A. (Oxon.), The Bungalow, Foxcombe Hill, near Oxford
1912	Trans.	Hartley, Harold, M.Sc. (Manc.), c/o The Richmond Gas Stove and Meter Co., Ltd., Academy-street, Warrington
1899	Trans.	Hartley, Harold Brower, M.A. (Oxon.), Balliol College, Oxford
1890	Trans.	Hartog, Philip Joseph, M.A. (Manc.), B.Sc. (Lond. and Vict.), University of London, South Kensington, S.W.
1900	Trans.	Hart-Smith, James, A.R.C.S., F.I.C., Camphene, Throwley- road, Sutton
1900	Trans.	Harvey, Alfred William, 136, Bargery-road, Catford, S.E.
1909		Harvey, Arthur John, 265, Burdett-road, Limehouse, E.
1885		Harvey, Ernest William, A.R.S.M., 36, Arthur-road, Wimble- don Park, S.W.
1881		Harvey, Sidney, F.I.C., Watling House, Canterbury
1907		Harvey, Thomas Featherstone, 69, North-road, West Bridgford, Nottingham
1911		Harwood, Henry Francis, M.Sc. (Manc.), Ph.D. (Heidelberg), Royal College of Science, S. Kensington, S.W.
1894		Hatfield, John Adams, F.I.C., c/o Messrs. J. Lysaght, Ltd., Orb Iron Works, Newport, Mon.
1912		Hatherly, Henry Medley, 14, Stackpool-road, Southville, Bristol
1892		Hatton, William Percy, c/o Messrs. W. R. Hatton and Sons, Ltd., Wormwood Scrubs, W.
1880		Hawkes, Alfred Edward, M.D. (Brussels), L.R.C.P. (Edin.), Mnspratt Laboratory, The University, Liverpool
1912		Hawkins, Walter Elmslie, B.Sc. (Lond.), 27, St. George's-road, Kilburn, N.W.
1894	Trans.	Haworth, Edward, D.Sc. (Vict.), Ivy Bank, Moughland-lane, Runcorn
1898		Haworth, John, 117, Millhouses-lane, Sheffield

Date of Election.		
1909	Trans.	Haworth, Walter Norman, D.Sc. (Manc.), Ph.D. (Göttingen), United College, The University, St. Andrews
1905	Trans.	Hawthorne, John, B.A. (R.U.I.), Ph.D. (Jena), F.I.C., 16, Donegall-square-south, Belfast
1907		Hay, William, 21, Louis-street, Spring-bank, Hull
1910		Haycock, John, Hill Top House, Great Glen, Leicester
1912		Haydon, Archie, 55, Grove-lane, Kingston-on-Thames
1910	Trans.	Hayhurst, Walter, M.Sc. (Manc.), Globe Chemical Works, Church, Accrington
1900		Haynes, James Herbert, B.Sc. (Vict.), Sennen, 65, Kennington-avenue, Ashley Down, Bristol
1909		Hayward, Eric, F.I.C., c/o W. R. Criper, Esq., Konnagar House, Konnagar, near Calcutta, India
1906		Hayworth, William Prince, F.I.C., Park View, Park-road, Dartford
1903		Heasman, Harold Montague, 2, Broadway, Westminster, S.W.
1891		Heath, John William, 1, Carlyle-square, Chelsea, S.W.
1898		Heaton, John, Southcliffe, Roker, Sunderland
1902		Heaton, Noël, B.Sc. (Lond.), 72, Abbey-road, N.W.
1906	Trans.	Hedley, Edgar Percy, Ph.D. (Leipzig), A.R.C.S.I., c/o Cape Explosivo Works, Somerset West, Cape Colony, S. Africa
1899		Hedley, George Ward, M.A. (Oxon.), The College, Cheltenham
1905		Heely, Frederick William, Analytical Laboratory, West-street, Alford, Lincs.
1876		C. 1895-9 Hehner, Otto, F.I.C., 11, Billiter-square, E.C.
1912	Trans.	Heilbron, Isidor Morris, Ph.D. (Leipzig), F.I.C., 7, Claremont-terrace, Glasgow
1889		Helbing, Heinrich B., 81, Queen Victoria-street, E.C.
1875		|| Hellon, Robert, Ph.D. (Heidelberg), A.R.S.M., F.I.C., Whin-thwaite, Seascale, viâ Carnforth
1872		|| Helm, Henry James, I.S.O., F.I.C., Simonstone, 27, Hammelton-road, Bromley, Kent
1899		Hembrough, James, A.R.C.S., A.I.C., Science, Art and Technical School, Market-street, Newton Abbot
1900		Hemingway, Frank Christian Richard, 17, Battery-place, New York City, U.S.A.
1898	Trans.	Hemmy, Arthur Stanley, Prof., B.A. (Cantab.), M.Sc. (Melbourne), Government College, Lahore, India
1885	Trans.	|| Henderson, George Gerald, Prof., M.A., D.Sc. (Glas.), Hon. LL.D (St. Andrews), F.I.C., The Royal Technical College, 204, George-street, Glasgow
1895	Trans.	Henderson, James, Ph.D. (Münich), B.Sc. (St. Andrews), c/o Horlick's Malted Milk Co., Racine, Wisconsin, U.S.A.

Date of
Election.

1905	Proc.		Henderson, James Alexander Russell, Prof., D.Sc. (Glas.), Chihli Provincial College, Paotingfu, N. China, via Siberia
1900	Trans.		Henderson, John Brownlie, F.I.C., Government Analyst, Brisbane, Queensland
1892			Hendrick, James, B.Sc. (Lond.), F.I.C., Marischal College, Aberdeen
1903			Hendrickson, Arthur V., The Gas Works, Lower Sydenham, S.E.
1909			Hendry, Robert Douglas, 16, Church-street, Alloa, N.B.
1912			Henius, Max, Ph.D. (Marburg), 1135, Fullerton-avenue, Chicago, Ill., U.S.A.
1901			|| Henley, The Hon. Francis Robert, M.A. (Oxon.), F.I.C., 9, Beaufort-gardens, S.W.
1905			Hennings, Carl Richard, Ph.D. (Freiburg), 19, St. Dunstan's-hill, E.C.
1899	Trans.		|| Henry, Thomas Anderson, D.Sc. (Lond.), 70, Doneraile-street, Fulham, S.W.
1905	Trans.		Henstock, Herbert, M.Sc. (Vict.), Ph.D. (Zürich), Wilcott House, Wilcott, near Nesscliffe, Shrewsbury
1913			Henville, Douglas, A.I.C., 67, Glencoe-street, Newington, Hull
1904			Henzell, Archie Willoughby, Prof., El Colegio Inglés, Quinta Jesus Maria, Quemados de Mariaano, Havana, Cuba
1895			Heriot, Thomas Hawkins Percy, 24, Woodberry-crescent, Muswell Hill, N.
1871			Herman, Douglas, F.I.C., Rainhill, Lancs.
1912			Heron, Harold, 110, Fenchurch-street, E.C.
1908			Heron, John Maxwell, North House, Mistley, Essex
1906			Herty, Charles Holmes, Prof., Ph.D. (Johns Hopkins), Ph.B. (Georgia), University of North Carolina, Chapel Hill, N.C., U.S.A.
1913			Hewitt, James Arthur, B.Sc. (St. Andrews), 3, South Bridge-street, St. Andrews
1892	Trans.	C. 1903-05, 1908-11	|| Hewitt, John Theodore, M.A. (Cantab.), D.Sc. (Lond.), Ph.D. (Heidelberg), F.R.S., Clifford House, Staines-road, Bedfont, Feltham, Middlesex
1900			Hewitt, Samuel, 53, Dover-street, Unthank-road, Norwich
1892			Hewlett, John Cooke, 35-42, Charlotte-street, Great Eastern-street, E.C.
1883	Trans.	{ C. 1897- 1901 }	|| Heycock, Charles Thomas, M.A. (Cantab.), F.R.S., 3, St. Peter's-terrace, Cambridge
1909	Trans.		Hibbert, Harold, D.Sc. (Vict.), Ph.D. (Leipzig), 400 W. 9th-street, Wilmington, Delaware, U.S.A.
1876	Trans.		Hibbert, Walter, F.I.C., 144, Walm-lane, Willesden Green, N.W.
1909			Hickinbotham, Reginald Vernon, 144, West-street, Maritzburg, Natal, S. Africa

Date of Election		
1881		|| Hiddingsh, Michael, Newlands, near Capetown, S. Africa
1905		Higgins, John Michael, 39, Queen-street, Melbourne, Australia
1907		Higham, Richard, 161, Mauldeth-road, Withington, Manchester
1909		Higson, Frank, Ivybank, Castle-street, Haulgh, Bolton
1908	Trans.	Hilditch, Thomas Percy, D.Sc. (Lond.), F.I.C., Birchdene, Cross-lane, Grappenhall, Cheshire
1896	Trans.	Hill, Arthur Croft, M.A., M.D. and B.S. (Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 169, Cromwell-road, S.W.
1896		|| Hill, Charles Alexander, B.Sc. (Lond.), F.I.C., 26, Courtfield-gardens, S.W.
1896	Trans.	Hill, Ernest George, Prof., Sc.D. (Dub.), B.A. and B.Sc. (Oxon.), Muir College, Allahabad, India
1911		Hill, James Grainger, Hillboro', Oak-street, Kingswinford, Dudley
1911		Hill, James Hogan, c/o Opium Agent, Ghazipur, U.P., India
1913		Hill, Percy Wolmer, 43, Holyhead-road, Wednesbury
1905		Hill, William Basil, Eastfield, Stockton-lane, York
1894		|| Hills, Edmond Herbert, Capt. R.E., F.R.S., 32, Prince's-gardens, S.W.
1892		|| Hills, Harold Fletcher, Commercial Gas Works, Stepney, E.
1906		Hills, James Stuart, F.I.C., Oxford Works, Tower Bridge-road, S.E.
1873		|| Hills, Walter, 50, Wigmore-street, W.
1896		Hinchley, John William, A.R.S.M., 55, Redcliffe-road, S.W.
1908		Hinks, Edward, B.Sc. (Lond.), F.I.C., 16, Southwark-street, S.E.
1900		Hinks, Percy John, A.R.C.S., F.I.C., Woodstock, Beaconsfield-road, Blackheath, S.E.
1894		Hirsch, Charles Theodore William, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Charlinch, Rectory-road, Woolwich, S.E.
1870		Hislop, George Robertson, Gasworks, Blackstoun-road, Paisley
1898		|| Hislop, Lawrence, Gasworks, Uddingston, Glasgow
1898		Hislop, Robert Findlay, Greenhill House, Paisley
1883		|| Hobbs, Bedo, Lamb Brewery, Chiswick, W.
1905		Hobsbaum, Isaac Berkwood, 13, Paget-road, Stoke Newington, N.
1901		Hobson, Edwin, Howdendyke, Howden, Yorks.
1884		Hodges, Herbert John, Brewery House, York-buildings, Southampton
1882	Trans.	|| Hodgkin, John, F.I.C., 97, Hamlet-gardens-mansions, Ravenscourt Park, W.
1879	Trans.	C. 1883-5, 1907-10 Hodgkinson, William Richard Eaton, Prof., Ph.D. (Würzburg), F.I.C., 89, Shooter's Hill-road, Blackheath, S.E.
1886		|| Hodgson, Christopher, 33, Oakdale-road, Netheredge, Sheffield
1911		Hodgson, Cyril Vincent, 52, London-road, Chesterton, New-castle, Staffs.

Date of
Election

1873		|| Hodgson, Henry Tylston, M.A. (Cantab.), Harpenden, Herts.
1904		Hodgson, Thomas Reginald, M.A. (Cantab.), F.I.C., 34, John Dalton-street, Manchester
1911	Trans.	Hodsman, Henry James, M.Sc. (Leeds), Dept. of Fuel and Coal Gas Industries, The University, Leeds
1913		Hodsoll, Harold Edward Pollock, 22, Pembridge-mansions, W.
1911		Hogg, Alexander Frederick, M.A. (Cantab.), 9, Wrotesley-road, Woolwich, S.E.
1885		Hogg, Edward Grindle, 1, Southwick-street, Hyde Park-square, W.
1883		Hogg, Walter Douglas, M.D. (Paris), 62, Champs Elysées, Paris
1876		Holerof, Harold, M.A. (Cantab.), Parkdale, Wolverhampton
1912		Holden, Edmund Haworth, M.Sc. (Viet.), 25, Curwen-street, Workington
1908		Holden, George Edward, 23, Durnford-street, Middleton, Manchester
1885		Holgate, Thomas, 61, Calton-road, Dulwich, S.E.
1903		Holland, Frank William Crossley-, Ashbourne, Woodquest-avenue, Herne Hill, S.E.
1908		Holland, Norman, 4907, Sherbrooke-street-west, Montreal, Canada
1902		Hollingworth, David Vincent, Birchenwood Collieries, Kids Grove, Stoke-on-Trent
1905		Hollins, Cecil, B.Sc. (Lond.), 103, Haydon's Park-road, Wimbledon, S.W.
1886		Holloway, George Thomas, A.R.C.S., F.I.C., 9-13, Emmett-street, Limehouse, E.
1895		Holme, Arthur Edward, M.A. (Oxon.), The Wheelwright Grammar School, Dewsbury
1897	Trans.	Holmes, John, Government Laboratory, Clement's Inn Passage, W.C.
1909		Holmyard, Eric John, B.A. (Cantab.), Midsomer Norton, Bath
1898	Trans.	Holroyd, George William Fraser, M.A. (Oxon.), The Chemical Works, Shoreham, Sussex
1913		Holroyd, Thomas Arthur, B.Sc., (Leeds), Carnbuck Club, Perambore Barracks, Madras, India
1902	Trans.	|| Holt, Alfred, M.A. (Cantab.), D.Sc. (Manc.), Dowsefield, Allerton, Liverpool
1910		Holt, Fred., M.Sc. (Manc.), c/o Messrs. Burt, Boulton & Haywood, Ltd., Prince Regent's Wharf, Silvertown, Victoria Docks, E.
1913		Holt, William Joseph, 31, Spruce Hills-road, Walthamstow, N.E.
1893		Holthouse, Harold Bertram, 106, Radcliffe-road, West Bridgford, Nottingham

Date of Election.		
1898		Honfray, David, B.Sc. (Lond.), F.I.C., c/o Senores La Compania de Fabricas de Papel de San Rafael, Apartado No. 469, Mexico City
1878		Hooker, Ayerst Henham, F.I.C., Board of Health, Cairo, Egypt
1892	Trans.	Hooker, Samuel Cox, Ph.D. (Munich), 82, Remsen-street, Brooklyn, N.Y., U.S.A.
1883		|| Hooper, David, F.I.C., Economic and Art Section, Indian Museum, 1, Sudder-street, Calcutta, India
1888	C. 1907-08	|| Hooper, Egbert Grant, F.I.C., 16, Royal-avenue, Sloane-square, S.W.
1891		|| Hooper, Ernest Frederick, c/o Messrs. Brotherton & Co., Ltd., 10, Elms-west, Sunderland
1912	Trans.	Hope, Edward, M.Sc. (Manc.), Lockingstoops, Lowton, Newton-le-Willows
1907		Hope, Geoffrey Dodleston, B.Sc. (Vict. and L'pool.), Ph.D. (Halle), c/o Indian Tea Association, Calcutta, India
1906		Hopkins, Frederick Gowland, M.A. (Cantab.), M.B., D.Sc., and L.R.C.P. (Lond.), M.R.C.S. (Eng.), F.R.S., F.I.C., Saxmeadham, Grange-road, Cambridge
1909		Hopkinson, Reginald, B.Sc. (Lond.), Cromwell Lodge, Huntingdon
1904		Horn, George Mathieson, Capt., Ivylands, Epping, Essex
1908		Hornby, Percy Hulme, c/o The Brentford Gas Co., Southall
1894		|| Hornby, Richard, M.A. (Oxon.), Haileybury College, Hertford
1911		Horne, William Joseph Chetwynd, c/o Messrs. Cleeve Bros., Lansdowne, Limerick; and Walnut House, Limerick, Ireland
1908		Horrobin, Arthur, c/o Bombay, Baroda and Central India Railway Co., Ajmer, Rajputana, India
1904		Horrod, George William Thomas, c/o Messrs. Fassett & Johnson, 86, Clerkenwell-road, E.C.
1897		Horseman, James Walter, Elstow School, Bedford
1892		Horsfall, John, 4, Grange-avenue, Rawtenstall, Manchester
1901	Proc.	Horton, Edward, B.Sc. (Lond.), 10, Smith-street, Chelsea, S.W.
1909		Hoseason, James Henry, Alderside, Timperley, Altrincham
1902		Hosking, Arthur Francis, c/o The Tasmania Gold Mining Co. Ltd., Beaconsfield, Tasmania
1886		|| Hoskins, Arthur Percy, F.I.C., Clonlee, Rosetta-park, Belfast
1911		Hough, Bernard Grindrod, The Chestnuts, Wardle-road, Sale, Manchester
1909		Hough, Ralph, 367, Moss-lane-east, Manchester
1871		Houlder, William Washington, North Hyde House, Southall
1887	Proc.	Houlding, William, B.Sc. (Edin.), 34, Tynemouth-street, Liverpool
1882		|| Howard, Alfred Gravely, Burnt House, Chigwell, Essex
1901		Howard, Bernard Farmborough, F.I.C., Quantoeks, Woodford Green, Essex

Date of
Election.

1870		{C. 1875-9 83-5, 98- 1902. V.P. 1886-9, 1903-06}	|| Howard, David, J.P., F.I.C., Devon House, Buckhurst Hill, Essex
1887	Trans.		|| Howard, David Lloyd, Little Friday Hill, Chingford, Essex
1889			Howard, George William, Calverley, Tunbridge Wells
1875			Howard, Thomas, F.I.C., 50, Ellington-street, Liverpool-road, N.
1903			Howarth, John George, Danes Dyke, Reigate-road, Reigate, Surrey
1882			Howe, James Lewis, Prof., M.D. (Louisville), Ph.D. (Göttingen), B.A. (Amherst), Washington and Lee University, Lexington, Va., U.S.A.
1913			Howells, Alfred Leslie, B.Sc. (Lond.), Bank Field, New Mill-road, Holmfirth, Huddersfield
1912			Howells, Oliver Richard, B.Sc. (Lond.), County Secondary School, Stowmarket
1905			Howgate, James Henry, B.A. (Lond.), The Grammar School, Huntingdon
1876			Howie, William Lamond, 26, Neville-court, Abbey-road, N.W.
1903			Howorth, Franklin Wise, 10, New-court, Lincoln's Inn, W.C.
1889			|| Hoyle, Richard Ashworth, Elm-grove, Fairlawn-road, Lytham, Lancs.
1889			|| Hoyles, Henry Richardson, 10, Fore-street, Wellington, Somerset
1907			|| Hubbard, The Hon. Raymond Egerton, B.A. (Oxon.), c/o Messrs. Egerton, Hubbard & Co., St. Petersburg, Russia; and Addington Manor, Winslow, Bucks.
1910			Huck, John, M.A. (Cantab.), The Foundation, St. Bees School, St. Bees, Cumberland
1900			Hudson, Edmund Foster, M.A. (Cantab.), Churcher's College, Petersfield, Hants.
1899	Trans.		Hübner, Julius, M.Sc. (Manc.), F.I.C., Linden, Cheadle Hulme, Stockport
1911			Hughes, Edwin Burnhope, B.Sc. (Lond.), Royal College, Mauritius
1903			Hughes, Edwin Reginald, 106, Queen Victoria-street, E.C.
1907			Hughes, Francis Townshend Cunynghame, Major, H.M.'s Assay Office, 47/1, Strand-road, Calcutta, India
1894	Trans.		Hughes, Frank, Turf Club, Cairo, Egypt
1880	Trans.		Hughes, George Henry, 155, Fenchurch-street, E.C.
1910			Hughes, Herbert Hillier, B.Sc. (Lond.), The Grammar School, Tottenham, N.
1868			Hughes, John, F.I.C., Analytical Laboratory, 79, Mark-lane, E.C.
1912			Hughes, John Owen, B.Sc., University College of N. Wales, Bangor
1908			Hughes, Joseph Albert, School of Mines, Charters Towers, Queensland, Australia
1896			|| Hughes, Joshua Arthur, The Square, Abercarn, Mon.

Date of Election.		
1885		Hughes, Theophilus Vaughan, A.R.S.M., F.I.C., 4, George-road, Edgbaston, Birmingham
1882		Hughes, Thomas, F.I.C., Borough Analyst's Office, 31, Loudoun-square, Cardiff
1908	Trans.	Hull, Thomas Ernest, Woodlands View, Newland-avenue, Birkby, Huddersfield
1904		Hulme, John, Ph.D. (Halle), 5, Duke-street, Macclesfield
1907	Trans.	Humphries, Herbert Brooke Perren, B.Sc. (Lond.), A.R.C.S., Queen Anne's-chambers, Westminster, S.W.
1883		Humphrys, Norton Henry, Gas Engineer, Salisbury
1885		Hunter, Matthew, M.A. (Oxon.), Rangoon College, Rangoon, Burma
1893	Trans.	Huntly, George Nevill, B.Sc. (Lond.), A.R.C.S., F.I.C., 14, Old Queen-street, Westminster, S.W.
1911		Hurst, Reginald, 233, Bellingham-road, Catford, S.E.
1902	Trans.	Hurtley, William Holdsworth, D.Sc. (Lond.), St. Bartholomew's Hospital, E.C.
1861		Huskisson, Henry Owen, F.I.C., Moon-street, Theberton-street, Islington, N.
1900		Hutchin, Henry William, Basset-road, Camborne, Cornwall
1894		Hutchinson, Alfred, M.A. (Cantab.), B.Sc. (Lond.), 3, Windsor-road, Saltburn-by-the-Sea
1890	Trans.	|| Hutchinson, Arthur, M.A. (Cantab.), Ph.D. (Würzburg), Pembroke College, Cambridge
1884		|| Hutchinson, Christopher Clarke, K.C., F.I.C., 13, The Boltons, S. Kensington, S.W.
1908		Hutchinson, Henry Brougham, Ph.D. (Göttingen), Wyver, Sponser-road, Harpenden, Herts.
1913		Hutchinson, James Joseph, The Biscuit Factory, Bishop-street, Dublin
1913		Hutchinson, Percy, B.Sc. (Lond.), Aden House, Manchester-road, Bury
1907		|| Hutchinson, William Doge, B.A. (Oxon.), Ungeverstrasse 11 (I), Munich, Germany
1900		|| Ichioka, Tajiro, Prof., Minamihara, Hiratsuka, Japan
1888		Idris, Thomas Howell Williams, M.P., 110, Pratt-street, Camden Town, N.W.
1907	Trans.	Ingham, Harry, M.Sc. (Vict.), Ashville College, Harrogate
1889	Trans.	|| Ingle, Herbert, B.Sc. (Leeds), F.I.C., 18, Crown-terrace, Scarborough
1904	Trans.	Inglis, John Kenneth Harold, Prof., D.Sc. (Edin.), M.A., and B.Sc. (N.Z.), F.I.C., University of Otago, Dunedin, New Zealand

Date of
Election.

1901		Ingram, Beresford, M.A. (Cantab.), Department of Agriculture and Technical Instruction, 17, Ely-place, Dublin
1897	Trans.	Innes, William Ross, D.Sc. (Vict.), Ph.D. (Heidelberg), F.I.C., 19, St. James'-avenue, Cricklewood, N.W.
1901		|| Ionides, Stephen Archigenes, B.A. (Oxon.), 92J, Foster-building, Denver, Colo., U.S.A.
1908	Trans.	Irvine, James Colquhoun, Prof. D.Sc. (St. Andrews), Ph.D. (Leipzig), Chemical Laboratory, The University, and Edgecliff, St. Andrews
1906		|| Irving, Henry Carlyle, B.A. (Oxon.), 2, High-street, Chingford, N.E.
1883		|| Irwin, Wilfred, Sunnyside, Papecastle, Cockermouth
1892		|| Isaac, John F. V., M.A. (Oxon.), 38, Silver-crescent, Gunnersbury, W.
1885		Ivatt, Albert, M.A. (Cantab.), The Engadine, Histon, Cambridge
1894		Jackman, Edwin James, 60, Belgrave-road, Ilford, Essex
1883		|| Jackson, Alfred Henrick, Prof., B.Sc. (Vict.), M.Inst.E.E., The Electrical Engineering School, 349, Collins-street, Melbourne, Australia
1894	Trans.	Jackson, David Hamilton, M.A. and B.Sc. (N.Z.), Ph.D. (Heidelberg), 95, Abbey-road, N.W.
1882		Jackson, Edward, F.I.C., Raven's Clift, Oxford-road, Moseley, Birmingham
1907		Jackson, Ernest Wilfrid, Godrevy, Saltburn-by-the-Sea
1900	Trans.	Jackson, Henry, M.A. (Cantab.), 3, Lygon-road, Edinburgh
1884	Trans.	Jackson, Herbert, Prof., F.I.C., Chemical Laboratory, King's College, Strand, W.C.
1909		Jackson, Robert Ernest, York-villa, Shepherd's-lane, Dartford
1892		|| Jackson, Samuel, A.R.C.S., F.I.C., 3, Buckingham-gardens, Perambore Barracks, N. Madras, India
1902		Jackson, William Brannan, Avalon, Balloch
1903		Jackson, William Henry, 73, Church-street, West Hartlepool
1910		Jacobs, Lionel Leslie, P.O. Box 445, Saulte Ste. Marie, Ont., Canada
1887		|| Jadhava, Khasberao Bhagawantrao, M.R.A.C., Mehsana, near Gujarat, India
1900		Jaffé, Adolf, 8, Leyburn-grove, Shipley, Yorks.
1878	Trans.	Jago, William, Barrister-at-Law, F.I.C., 1, Garden-court, Temple, E.C.; and 17, Wilbury-avenue, Hove, Sussex
1912		Jamas, Ardesir Naserwanji Peston, M.A. and B.Sc. (Bombay), Karrim Building, Grant-road, Bombay, India
1912		James, Charles, New Hampshire College, Durham, N.H., U.S.A.

Date of
Election.

1912			James, Edward Lewis, Holly Lodge, Larkhall-rise, Clapham, S.W.
1912			James, Edwin Oliver, Rev., St. Peter's Parsonage, Hucknall Torkard, Nottingham
1904	Trans.		James, Thomas Campbell, M.A. (Cantab.), B.Sc. (Wales), Edward Davies' Chemical Laboratories, University College of Wales, Aberystwyth
1901	Proc.		Jamieson, James Sprunt, F.I.C., Government Laboratory, Durban, Natal, S. Africa
1879	Trans.	{ C.1882-5 F.S. 85-91 V.P.95-9 }	†Japp, Francis Robert, Prof., M.A. and Hon. LL.D. (St. Andrews), F.R.S., F.I.C., The University, Aberdeen
1910			Jaques, Arthur, M.Sc. (Dun.), F.I.C., c/o Nobel's Explosives Co., Polmont Station, Stirlingshire
1902			Jardin, David Smith, A.R.C.S.I., F.I.C., Lynwood, Dundrum, Co. Dublin
1902			Jardine, Douglas Kennedy, B.Sc. (Vict.), c/o Daily Chronicle Office, Georgetown, Demerara, British Guiana
1882			Jarmay, Gustav, F.I.C., Hartford Lodge, Hartford, Cheshire
1905	Proc.		Jarrard, William John, B.Sc. (Lond.), A.R.C.S., The University, Sheffield
1896	Proc.		Jeffers, Ernest Haynes, 87, Kyrle-road, West-side, Clapham Common, S.W.
1909			Jeffery, John Hugh, 10, Daysbrook-road, Streatham Hill, S.W.
1911			Jenkin, William Alfred, 6, Bella-vista, Rio Tinto, Provincia de Huelva, Spain
1891	Trans.		Jenkins, Henry Charles, Wh.Sc., A.R.S.M., Assoc. M.Inst.C.E., F.I.C., Abergeldie, Alma-road, Clifton, Bristol
1904			Jenkins, Herbert, 19, Bank-street, Braintree
1892			||Jenkins, John H. B., Chemical Laboratory, Great Eastern Railway Works, Stratford, E.
1910			Jenkins, Leslie Charles Wood, 26, Ulundi-road, Blackheath, S.E.
1906	Trans.		Jenkinson, Ernest Arthur, 7, Jersey-road, Strood, Rochester
1894			Jenks, Robert Leonard, A.C.G.I., F.I.C., Custom House, Calcutta, India
1894			Jennison, Francis Herbert, F.I.C., 11, Upton-avenue, Upton- lane, Forest Gate, E.
1897	Trans.		||Jerdan, David Smiles, M.A. (Glas.), D.Sc. (Vict.), Ph.D. (Heidelberg), Temora, Colinton, Midlothian
1898			Jessop, Samuel Morton, 19, Burton-street, Wakefield
1912			Jewell, William, A.I.C., 113, Mount Pleasant-road, Lewisham, S.E.
1879			Jewson, Francis Albert Bowen, F.I.C., 4, Manor-gardens, Lark- hall Rise, S.W.

† Longstaff Medallist, 1891.

Date of
Election

1912	Trans.	Jobling, Edgar, B.Sc. (Lond.), A.R.C.S., 26, Doughty-street, Mecklenburgh-square, W.C.
1901		Johnson, Charles Harold, M.D., C.M., F.R.C.S. and M.R.C.P. (Edin.), Kerang, Victoria, Australia
1908		Johnson, Grove, 21, Murphy-street, Richmond, Melbourne, Australia
1883		Johnson, James Edward, F.I.C., 133, Earlham-grove, Forest Gate, E.
1904		Johnson, John Richard, c/o The National Drug and Chemical Company, Ltd., Vancouver, British Columbia
1906		Johnston, Archibald McArthur, Box 108, Germiston, Transvaal, S. Africa
1904		Johnston, John Haslam, M.Sc. (Vict.), F.I.C., 8, Leopold-road, Wimbledon, S.W.
1896		Johnstone, James, F.I.C., Braehead, Parkhill, Rutherglen
1903		Jones, Alfred Owen, 48, Seymour-road, Bishopston, Bristol
1907		Jones, Benjamin Owen, Boksburg, Transvaal, S. Africa
1905	Trans.	Jones, Bernard Mouat, M.A. (Oxon.), Imperial College of Science and Technology, S. Kensington, S.W. ; and University Hall of Residence, Cheyne Walk, Chelsea, S.W.
1912		Jones, Edgar Dingle, 3, Neville-road, Waterloo, Liverpool
1898		Jones, Edward, B.Sc. (Lond.), F.I.C., 15, Macanlay-road, Clapham, S.W.
1905		Jones, Edward Towyn, M.Sc. (Wales), A.I.C., 19, Preston-avenue, Newport, Mon.
1871	Trans.	Jones, Edward William Taylor, F.I.C., The Oaklands, and 10, Victoria-street, Wolverhampton
1873	Trans.	|| Jones, Francis, M.Sc. (Manc.), F.R.S.E., 17, Whalley-road, Whalley Range, Manchester
1894		|| Jones, George Cecil, A.C.G.I., F.I.C., 43, Great Tower-street, E.C.
1893		Jones, Hedley Gordon, F.I.C., 32, Beechhill-road, Eltham, S.E.
1876	Trans.	|| Jones, Henry Chapman, F.I.C., Royal College of Science, S. Kensington, S.W.
1909		Jones, Henry Humphrys, 18, Colquitt-street, Liverpool
1878		Jones, Henry Williams, Westbourne, Gravelly Hill, Birmingham
1913		Jones, Hilton Ira, Prof., Dakota Wesleyan University, Mitchell, S. Dakota, U.S.A.
1904		Jones, Horace Francis, Rose Bank, Cambridge-road, Uxbridge
1890		Jones, John Archyll, B.Sc. (Lond.), Reethville, Park-road, West Hartlepool
1901		Jones, John Lloyd Thomas, Col., I.M.S., M.B. (Dun.), M.R.C.S. (Eng.), D.P.H. (Cantab.), His Majesty's Mint, Bombay, India

Date of Election.		
1892	Trans.	Jones, Lionel Manfred, B.Sc. (Lond.), Municipal Technical School, Suffolk-street, Birmingham
1906		Jones, Llewelyn Thomas, B.Sc. (Wales), Sunnyside, Tyrfran, Llanelly
1891		Jones, Moses William, Stone Beck, Brislington, Bristol
1912		Jones, Richard Arnold Seymour, M.Sc. (Leeds), Oaklands, Hilltop, Latchford, Warrington
1901		Jones, Robert Henry, M.Sc. (Vict.), The Harris Institute, Preston
1898		Jones, Thomas Hill-, Invicta Mills, Bow-common-lane, E.
1904		Jones, William App, A.M. (North Carolina), Ph.D. (Baltimore), c/o The Boston Artificial Leather Co., 200, Fifth-avenue, New York City, U.S.A.
1910	Trans.	Jones, William Jacob, M.Sc. (Wales), 2, Lancaster-road, Fallow-field, Manchester
1904	Trans.	Joseph, Alfred Francis, Prof., B.Sc. (Lond.), A.R.C.S., Ceylon Technical Schools, Colombo, Ceylon
1911		Joseph, Edward Lionel, 96, Victoria-street, S.W.
1910		Joshi, Govind Laxman, Pulgaon Mills, Pulgaon, C.P. India
1893	Trans. C. 1906-09	Jowett, Hooper Albert Dickinson, D.Sc. (Lond.), 5, Miskin-road, Dartford, Kent
1900		Joyce, Thomas Goode, B.Sc. (Lond.), F.I.C., Lyttleton Preserve and Drysaltery Works, Bromford-lane, West Bromwich
1893		Káká, Sorabji Manekji, Devon Villa, Karachi, Sind, India
1913		Kanga, Darab Dinsha, M.A. (Bombay), Indian Institute of Science, Hebbal, Bangalore, India
1886	Trans.	Kawakita, Michitada, Engineering College, Tokio, Japan
1905	Trans.	Kay, Sydney Alexander, D.Sc. (St. Andrews), Chemistry Department, The University, Edinburgh
1881	Trans.	|| Kay, William Edward, 349, The Cliff, Broughton, Manchester
1907	Trans.	Kaye, John, M.A. and B.Sc. (Glas.), North Britain Glass Works, Perth
1886	Trans. C. 1903-5	|| Keane, Charles Alexander, D.Sc. (Vict.), Ph.D. (Erlangen), F.I.C., The Sir John Cass Technical Institute, Jewry-street, Aldgate, E.C.
1882		|| Keen, Austin, Hon. M.A. (Cantab.), Cefn Lllys, Bentley-road, Cambridge
1912		Keenan, Thomas John, 751, East Nineteenth-street, Brooklyn, N.Y., U.S.A.
1908		Keiller, Patrick Anderson, B.Sc. (St. Andrews), c/o Colombo Commercial Co., Ltd., Colombo, Ceylon
1894		|| Kellas, Alexander Mitchell, B.Sc. (Lond.), 4, St. Mark's-crescent, Regent's Park, N.W.; and Chemical Dept., Middlesex Hospital Medical School, Cleveland-street, W.

Date of
Election.

1913		Keller, Douglas Rayment, B.Sc. (Lond.), A.C.G.I., 48, Weymouth-street, Watford
1874		Kellner, William, Ph.D. (Göttingen), F.I.C., 135, Victoria-road, Old Charlton, Kent
1882		|| Kemp, William Joel, F.I.C., Kelowna, Haddacks Hill-road, Bexhill-on-Sea
1903		Kemp-Welch, Maurice, B.A. (Cantab.), Corrie, Ashted, Epsom
1884		Kendall, George Frederic, B.A. (Cantab.), The Hollies, Stratford-on-Avon
1874		Kendall, James Alfred, F.I.C., Lonesome Chemical Works, Streatham Common, S.W.
1910	Trans.	Kenner, James, Ph.D. (Heidelberg), B.Sc. (Lond.), The University, Sheffield
1896		|| Kennicott, Cass Langdon, Chicago Heights, Illinois, U.S.A.
1903		Kent, Thomas Oliver, Handforth Laboratories, Handforth-road, Kennington, S.E.
1889		Kenwood, Henry Richard, M.B. and C.M. (Edin.), L.R.C.P. (Lond.), 126, Queen's-road, Finsbury Park, N.
1908	Trans.	Kenyon, Joseph, B.Sc. (Lond.), F.I.C., 51, Irving-place, Blackburn
1903		Kerr, James Stewart, A.R.C.S., F.I.C., 19, Reservoir-road, Edgbaston, Birmingham
1883		Kerry, William Hugh Rubens, The Sycamores, Windermere
1900		Kershaw, James Henry, Corporation Sewage Works, Dalton, Rotherham, Yorks.
1901		Kettle, James David, B.Sc. (Lond.), F.I.C., 3, Huguenot-mansions, East-hill, Wandsworth, S.W.
1902		Kewley, James, M.A. (Cantab.), c/o Anglo-Egyptian Oilfields, Ltd., Suez, Egypt
1910		Khan, Prince Mahmood Ali, B.A. (Western Univ.), Zafermanzil, Rampur State, U.P., India
1911		Khosla, Sant Ram, near Kotwah City, Lahore, India
1905		Killby, Leonard Gibbes, B.A. and B.Sc. (Oxon.), 21, Portland-court, Great Portland-street, W.
1903		Kin, Thein, B.A. (Calcutta), Chemical Examiner's Office, Rangoon, Lower Burma, India
1872	Trans. C. 1887-92	|| Kinch, Edward, Prof., F.I.C., Royal Agricultural College, Cirencester
1907	Trans.	King, Albert Theodore, B.Sc. (Lond.), F.I.C., Church-hill, Horsell, Woking, Surrey
1881	Trans.	King, Alfred John, Elleray, Windermere
1902		|| King, Frank Eustace, B.Sc. (Lond.), F.I.C., 75, Gracechurch-street, E.C.
1903		King, Frank William George, 15, Almond-road, Tottenham, N.
1911	Trans.	* King, Harold, M.Sc. (Wales), 24, The Brent, Dartford

Date of Election.		
1897		King, Herbert, M.Sc. (Vict.), F.I.C., 8, Avenue-road, Scarborough
1902		King, James Kirkman, B.A. (Cantab.), 51, Mount Gold-road, Plymouth
1876		King, John Falconer, F.I.C., 30, Chambers-street, Edinburgh
1902		King, Sidney Isaac, Brea, Upton-road, Bexley Heath, Kent
1895		Kingdon, George Holman, M.A. (Oxon.), c/o Messrs. Crosfield, Ltd., Warrington; and Hill Crest, Frodsham, Warrington
1872	Trans.	|| Kingzett, Charles Thomas, F.I.C., Newlands, St. George's-avenue, Weybridge, Surrey; and Maplin, Frinton-on-Sea, Essex
1891	Trans.	†|| Kipping, Frederic Stanley, Prof., D.Sc. (Lond.), Ph.D. (Munich) F.R.S., F.I.C., University College, Nottingham
1886		Kirby, Herbert Edward, 14, Newman-street, Oxford-street, W.
1909		Kirby, Oswald Farquhar, M.A., and B.Sc. (Aberd.), The Triangle, Oudtshoorn, Cape Colony, S. Africa
1895		|| Kirkaldy, Patrick Henry, Prof., F.I.C., Chemical Department, King's College, Strand, W.C.
1903		Kirkby, William, M.Sc. (Manc.), Winster House, Thornfield-road, Heaton Moor, Stockport
1913		Kirkland, Thomas James, Rev., B.Sc. (Lond.), Hereward Hall, Ely
1889		Kitchin, John, The Middlesex Hospital, W.C.
1888		|| Knaggs, Alfred Battye, 37, Mannville-terrace, Bradford
1910	Proc.	Knecht, Edmund, Prof., M.Sc. Tech. (Manc.), Ph.D. (Zürich), F.I.C., Beech Mount, Marple, Stockport
1903		Knight, Harley Faneut, F.I.C., 14, Old Queen-street, Westminster, S.W.
1894		Knight, James, M.A. and D.Sc. (Glas.), St. James's Public School, Calton, Glasgow
1896		Knight, John Burnett, Biskra, Malford-grove, South Woodford, N.E.
1894		Knight, William Albert, Sexey's Trade School, Bruton, Somerset
1910	Trans.	Knight, William Arthur, M.A. (Cantab.), B.Sc. (Lond.), M.Sc. (Bristol), 8, Gloucester-row, Clifton, Bristol
1878		Knights, James West, F.I.C., County Laboratory, Cambridge
1879		Knowles, Joshua, c/o J. H. Greenhalgh, Esq., Bingswood Printing Co., Ltd., Whaley Bridge, Stockport
1912		Knox, Archibald, 18, Newhall-terrace, Greenhead, Glasgow
1864		Knox, George Walter, B.Sc. (Lond.), 16, Finsbury-circus, E.C.
1873		Koch, Walter Edward, M.A. (Cantab.), P.O. Box 718, El Paso Texas, U.S.A.
1887	Trans.	Koga, Yoshimasa, The Imperial Mint, Osaka, Japan

Date of
Election.

1912		Komatsu, Shigeru, Institute of Chemistry, Imperial University, Kyoto, Japan
1904	Trans.	Komppa, Gustav, Prof., Ph.D. (Helsingfors), Polytechnik, Helsingfors, Finland
1885		Koningh, Leonard de, F.I.C., 4, St. Martin's-road, Stockwell, S.W.
1910		Krall, Hans, B.A. (Dub.), A.I.C., Trinity College, Dublin
1892		Krause, Georg, Prof. Dr., Cöthen (Anhalt), Germany
1908	Proc.	Krishnayya, H. V., B.A. (Madras), Government Chemical Laboratory, Mallesvaram, Bangalore, Mysore, India
1912	Trans.	Kuntgen, Harold Eric, c/o The Australian Glue and Gelatine Works, Alexandria, Sydney, N.S.W.
1913		Kur, Emmanuel Francis, Learansa, Devonshire-road, St. Anne's-on-the-Sea, Lancs.
1910		Kwob, Sea-Kwain, c/o Ta-Chou Electric Lighting Co., Lily Pond, Chinkiang, China
1859	Trans.	Kynaston, Josiah Wyckliffe, F.I.C., Chemical Laboratory, 3, Oak-terrace, Beech-street, Liverpool
1900		Kynaston, William Charles Robert, 9, Harland-road, Higher Tranmere, Birkenhead
1912		Lacey, Edwin Charles, St. Julian's Lodge, West Norwood, S.E.
1906		Ladell, William Richard Simpson, F.I.C., Grootfontein, Middelburg, Cape Province, S. Africa
1909		Lakhani, Hassum Alidina, M.D. (Brussels), Murud Janjira, Bombay Presidency, India
1893		Lamb, Edmund George, M.A. (Oxon.), M.P., Borden Wood, Liphook, Hants.
1900		Lamb, Morris Charles, The Leathersellers Technical College, 176, Tower Bridge-road, S.E.
1910		Lamb, Samuel, A.R.S.M., May Villa, Birmingham-road, West Bromwich
1892	Trans.	Lamb, Thornton Charles, Ph.D. (Heidelberg), c/o Messrs. Brunner, Mond and Co., Crescent Wharf, Silvertown, E.
1910	Trans.	Lambert, Bertram, M.A. (Oxon.) 34, Leckford-road, Oxford
1893		Lambert, Wesley J., 55, Plumstead Common-road, Plumstead, Kent
1912		Lampitt, Leslie Herbert, M.Sc. (Birm.), La Meunerie Bruxelloise, Haren-Nord, Brussels
1903	Proc.	Lamplough, Francis Edward Everard, M.A. (Cantab.), Trinity College, and Storey's-way, Cambridge
1877		Lancaster, William James, F.R.C.S., Pine Crest, Barnt Green, Worcs.
1902	Proc.	Laudan, A. Lionel, 24, Leigh-road, Highbury Park, N.

Date of Election		
1900	Trans.	Lander, George Druce, D.Sc. (Lond. and St. Andrews), F.I.C., Royal Veterinary College, Camden Town, N.W.
1897	Trans.	Lang, William Robert, Prof., D.Sc. (Glas.), F.I.C., The University, Toronto, Canada
1899		Lange, Ernest Frederick Stephen, c/o Messrs. Beyer, Peacock & Co., Ltd., Gorton Foundry, Manchester
1885		Langer, Charles, Ph.D. (Zürich), Ynyspenllwch, Clydach, Glam.
1891		|| Langham, Edgar Norman, Rev., M.A. (Cantab.), Rastrick Grammar School, Brighouse
1912	Trans.	Langton, Harold McKee, B.Sc. (Lond.), Melton, Aylestone-road, Cambridge
1912	Trans.	Lankshear, Frederick Russell, B.A. (N. Z.), M.Sc. (Manc.), Dalton Hall, Victoria Park, Manchester
1894	Trans.	C. 1904-7 Lapworth, Arthur, Prof., D.Sc. (Lond.), F.R.S., F.I.C., The University, Manchester
1908		Larmuth, Lionel Gordon, Gaythorn, Hazel-grove, Stockport
1901	Proc.	Larter, Alfred Tabois, B.Sc. (Lond.), 86, Inderwick-road, Stroud Green, N.
1883		Lascelles, Brian Piers, M.A. (Oxon.), Headland, Mount-park, Harrow-on-the-Hill
1901	Trans.	Lattey, Robert Tabor, Royal Naval College, Dartmouth
1906		Lattey, William Tabor, Tarmon, Streatham Park, S.W.
1891	Trans.	|| Lander, Alexander, Prof., D.Sc. (Edin.), F.I.C., Edinburgh and East of Scotland College of Agriculture, 13, George-square, Edinburgh
1886	Trans.	Laurie, Arthur Pillans, Prof., M.A. (Cantab.), D.Sc. (Edin.), F.R.S.E., The Heriot-Watt College, Edinburgh
1910		Lavender, John Herbert, 6, Croslands-park-road, Barrow-in- Furness
1876		|| Law, Channell, The Museum, Torquay
1905	Trans.	Law, Herbert Drake, B.Sc. (Lond.), Roselea, Western-road, Southall
1896		|| Law, Herbert Edward, 636, Pine-street, San Francisco, Cal., U.S.A.
1890	Trans.	|| Law, Robert, Major, F.I.C., The Royal Mint, Melbourne, Australia
1902		Lawrence, Henry William, Johnsonville, Wellington, New Zealand
1900		Laws, Arthur Robert, B.Sc., (Lond.), 90, St. George's-terrace, Newcastle-on-Tyne
1911	Trans.	Laws, Ernyst Graham, B.A. (Oxon.), 2, Hengist-villas, South- wood-road, Ramsgate
1882		Laws, Joseph Parry, F.I.C., Laurel Bank, Claremont-road, Headingley, Leeds

Date of
Election.

1913		Lawson, Joseph Stuart, 18, Old Swan-lane, Upper Thames-street, E.C.
1890		Lea, Arthur Sheridan, M.A. and Sc.D. (Cantab.), F.R.S., Sunnyside, Sideup, Kent
1886		|| Leach, Walter, 21, St. Andrew's-place, Bradford
1902		Leader, George Herbert, Montego Bay Secondary School, Montego Bay, Jamaica
1894	Trans.	|| Lean, Bevan, B.A. and D.Sc. (Lond.), Sidecot School, Winscombe, Somerset
1888		Lease, Frank Edward, Sapong Estate, Fort Birch, British North Borneo
1902		Leather, John Petty, Whittier, Colne-road, Burnley, Lanes.
1891	Trans.	Leather, John Walter, V.D., Ph.D. (Freiburg), F.I.C., Agricultural Research Institute, Pusa, Behar and Orissa, India
1900		|| Leathes, John Beresford, Prof., M.A., M.B. and B.Ch. (Oxon.), F.R.C.S. (Eng.), F.R.S., The University, Toronto, Canada
1889		Ledingham, Laurence Napier, Govandale, Taptonville-erecent, Sheffield
1883		Lee, Herbert Cabry, c/o The London Joint Stock Bank, 37, Market-terrace, Kingston-on-Thames, Surrey
1897	Trans.	|| Lee, Theophilus Henry, Servizio Geologico e Mineralogico do Brazil, Ministeria de Agricultura, Rio de Janeiro, Brazil
1909		Leech, Benjamin, M.A. (Cantab.), Beech Knoll, Macclesfield
1910		Leechman, Alleyne, B.A. (Oxon.), Government Laboratory, George Town, British Guiana
1905		Leek, William Henry, B.A. (Lond.), Brookwood, Leigh, Lanes.
1903	Trans.	Lees, Frederic Herbert, F.I.C., 31, Summerhill-road, Dartford, Kent
1913		Lefebure, Victor, B.Sc. (Lond.), 25, Belitha-villas, Barnsbury, N.
1889		|| Legg, John Edmund, M.A. (Cantab.), F.I.C., Cae Rhys, Dorchester-road, Weymouth
1901		Lehmann, Adolf Ludwig Ferdinand, B.Sc. (Toronto), Ph.D. (Leipzig), University of Alberta, Stratheona, Alberta, Canada
1903		Leigh, Arthur Graham, jun., New Park-place, Chorley, Lanes.
1889		Leigh, Cecil, F.I.C., Birmingham Metal and Munitions Co., Ltd., Adderley Park Rolling Mills, Birmingham
1913		Leitch, Peter Thomas, c/o John Edgar Esq., 176, West George-street, Glasgow
1904		Le May, Percy Kent, 6, Lothair-villas, Hatfield, Herts.
1912		Lenfestey, Harold John de Quetteville, 50, Tettenhall-road, Wolverhampton
1891		Lennox, Robert Nicol, Morvah, Hartington-road, Chiswick, S.W.
1906	Trans.	Le Rossignol, Robert, B.Sc. (Lond.), A.I.C., Prinz Regentenstrasse 108, Berlin, W., Germany

Date of Election.		
1904		Lessing, Rudolf, Ph.D. (Munich), Southampton House, 317, High Holborn, W.C.
1902		|| Lessner, Charles Blüthner, Carril, Spain
1895	Trans.	C. 1907-11 || Le Sueur, Henry Rondel, D.Sc. (Lond.), F.I.C., St. Thomas's Hospital, S.E.
1879		Letts, Edmund Albert, Prof., Hon. D.Sc. (R.U.I.), Ph.D. (Göttingen), F.I.C., Queen's College, Belfast
1903		Levy, Henry Wolff, 423B, Little Collins-street, Melbourne, Australia
1909	Trans.	Levy, Leonard Angelo, M.A. (Cantab.), D.Sc. (Lond.), F.I.C., 28, Teignmouth-road, Cricklewood, N.W.
1912	Trans.	Levy, Stanley Isaac, B.A. (Cantab.), B.Sc. (Lond.), St. John's College, Cambridge
1888	Trans.	Lewes, Vivian Byam, Prof., F.I.C., 30, Croom's-hill, Greenwich, S.E.
1907		Lewis, Carl, Lewis'-buildings, President-street, Germiston, Transvaal, S. Africa
1899	Trans.	Lewis, Edward Watkin, Hollycroft, Loughton, Essex
1901	Proc.	Lewis, Ernest Alfred, 310, Dudley-road, Birmingham
1910		Lewis, Frederick Charles, School of Pathology, Yates Laboratories, The University, Liverpool
1910	Trans.	Lewis, Samuel Judd, D.Sc. (Tübingen), B.Sc. (Lond.), F.I.C., The Laboratories, Staple Inn-buildings, High Holborn, W.C.
1909	Trans.	Lewis, William Cudmore McCullagh, Prof., M.A. (R.U.I.), D.Sc. (L'pool.), The University, Liverpool
1894	Trans.	Lewis, William Henry, M.A. (Oxon.), F.I.C., Royal Albert Memorial College, Exeter
1869	Trans.	|| Lewis, William James, Prof., M.A. (Oxon. and Cantab.), F.R.S., New Museums, Cambridge
1888	Trans.	C. 1902-03 || Lewkowitsch, Julius, M.A. and Ph.D. (Breslau), F.I.C., 71, Priory-road, West Hampstead, N.W.
1896		Lidgey, Cecil Rudolf, 45, Cresswell-road, East Twickenham
1900		Liebinann, Adolf, M.A. and Ph.D. (Bonn), The Whim, Weybridge
1903		Lindsay, John Howard, c/o The Nivalbo Co., Mapperley, Nottingham
1901		|| Linde, Harold Theodor Granville van der, c/o Century Rubber Co., Plainfield, N.J., U.S.A.
1908		Lindley, Arthur Stanley, laboratory, Prince-building, Meadows-street, Bombay, India
1899		Lindsey, Robert William, 1, Dartmouth-park-avenue, N.W.
1911		Linenbröker, Henry Edmund, 100, Harrow-road, Paddington, W.
1886	Trans.	C. 1911-13 Ling, Arthur Robert, F.I.C., 74, Great Tower-street, E.C.
1911		Ling, Herbert James, Hankow Dispensary, Hankow, China.
1899		Linstead, Edward Flatman, 15, Station-avenue, Winchmore Hill, N.

Date of
Election.

1902			Liotard, Ernest, 2, Rue de France, Nice, France
1905	Trans.		Lister, Joseph, B.Sc. (Lond.), Ph.D. (Leipzig), A.R.C.S., The Technical Institute, Tunbridge Wells
1853	Trans.	{ V.P. 1833-7, 1898-1901. }	|| Liveing, George Downing, Emeritus Prof., M.A. (Cantab.), Hon. Sc.D. (Cantab. & Dub.), F.R.S., F.I.C., The Pightle, Cambridge
1872	Trans.	V.P. 1910-13	|| Liversidge, Archibald, Emeritus Prof. M.A. (Cantab.), Hon. LL.D. (Glas.), A.R.S.M., F.R.S., F.I.C., Fieldhead, Coombe Warren, Kingston-on-Thames
1903			Livesey, Charles Edwin Leonard, B.Sc. (Vict.), Stonyhurst College, Blackburn, Lancs.
1883			Livingston, William John, F.I.C., 30, Fountayne-road, Stoke Newington Common, N.
1909			Livsey, Harry, 26, Thorpe-street, Old Trafford, Manchester
1880			|| Lloyd, Alfred, The Dome, Bognor, Sussex
1913			Lloyd, Daniel William, B.Sc. (Lond.), The Manse, Ormonde- road, Kilkenny
1876	Trans.		Lloyd, Frederick James, F.I.C., 3, New-street, Bishopsgate, E.C.
1905			Lloyd, George Moss, M.A. (Vict.), M.Sc. (L'pool.), National Correspondence College, S. Kensington, S.W.
1913			Lloyd, Harold Charles, B.Sc. (Birm.), Lawrence House, Mostyn- avenue, Llandudno
1907			Lloyd, Percival George, Kelvinside, Lower Ham-road, Kingston- on-Thames
1896			Lloyd, Thomas Henry, F.I.C., c/o Messrs. Quibell Bros., Ltd., Newark-on-Trent
1900			Lockhart, Thomas Lamb, c/o D. T. Hall, Esq., Box 3663, Johannesburg, Transvaal, S. Africa
1902			Logan, Thomas Stratford, Devon County Asylum, Exminster, Devon
1912			Lomax, Ernest Lawson, M.Sc. (Manc.), Mowbreck, Farington, Preston
1884			London, John Edward, M.D. (Dun.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), 62, Main-street, Georgetown, Demerara, W. Indies
1910	Trans.		|| Long, Frank Stevenson, B.Sc. (Lond.), 80, Tylney-road, Forest Gate, E.
1910			Longman, Charles Herbert Bell, A.R.C.S., Tientsin Anglo- Chinese College, Tientsin, N. China, via Siberia
1872			|| Longstaff, George Blundell, M.A. and M.D. (Oxon.), F.R.C.P., (Lond.), M.R.C.S. (Eng.), Highlands, Putney Heath, S.W.
1904			Longstaff, James Patrick, D.Sc. (Edin.), Chemistry Dept., The University, Edinburgh
1873	Proc.		|| Loram, Herbert Yabsley, F.I.C., 49, Buxton-road, Chingford, Essex
1878	Trans.		|| Louis, David Alexander, F.I.C., 123, Pall Mall, S.W.

Date of Election.		
1882		Love, Edward Gurley, Ph.D. (Columbia), 80, East 55th-street, New York City, U.S.A.
1882		|| Lovibond, Thomas Watson, F.I.C., West Jesmond House, Newcastle-on-Tyne
1910		Low, Kenneth Stewart, A.R.S.M., 10, Paul-street, Finsbury, E.C.
1910	Trans.	|| Lowe, Clement Ward, F.I.C., Thorneyholme, Knutsford
1904	Trans.	Lowe, Frank Harold, M.Sc. (Vict.), 4, Ranelagh-gardens, Hurlingham, S.W.
1878		|| Lowe, Walter Bezant, M.A. (Cantab.), Cae Carw, Llanfairfechan, Carnarvonshire
1876		Lowe, William Foulkes, A.R.S.M., F.I.C., 18, Hough-green, Chester
1898	Trans.	C. 1912- || Lowry, Thomas Martin, D.Sc. (Lond.), 130, Horseferry-road, Westminster, S.W.
1901		Lowson, William, B.Sc. (Lond. and Leeds), F.I.C., The University, Leeds
1899		Lucas, Alfred, F.I.C., Survey Department, Finance Ministry, Giza, Egypt
1905		Lucas, Edward William, F.I.C., Oxford Works, Tower Bridge-road, S.E.
1902		Lucas, Harry, The South of England College of Pharmacy, 186, Clapham-road, S.W.
1911		Lucas, Thomas Riley, A.C.G.I., Bhubaneswar, Orissa, India
1912		Lucas, William Thornton, B.A. (Cantab.), 48, Rosebery-avenue, Westoe, South Shields
1905		Luck, Alfred Courtenay, Laboratorio de Polvoras, Ministerio de Marina, Darsena Norte, Buenos Ayres, Argentine, S. America
1910		Lucking, Hubert Leslie, Ph.D. (Heidelberg), A.I.C., Tiffenden, Woodstock-road, Golders Green, N.W.
1902	Trans.	Ludlam, Ernest Bowman, D.Sc. (L'pool.), M.Sc. (Vict.), Clifton College, Bristol
1877	Trans.	|| Luff, Arthur Pearson, M.D., B.Sc., F.R.C.P. and L.S.A. (Lond.), M.R.C.S. (Eng.), D.P.H. (Glas.), F.I.C., 9, Queen Anne-street, Cavendish-square, W.
1890	Trans.	Lumsden, John Scott, D.Sc. (St. Andrews), Ph.D. (Munich), 1, Somerville-place, West-park, Dundee
1907		Lunan, George, 50, Garscube-terrace, Murrayfield, Edinburgh
1909		Lundholm, Carl Olof, F.I.C., 33, Beulah-hill, Upper Norwood, S.E.
1872	Trans.	|| Lupton, Sydney, 102, Park-street, Grosvenor-square, W.
1893	Trans.	|| Luxmoore, Charles Mann, D.Sc. (Lond.), F.I.C., 19, Disraeli gardens, Putney, S.W.
1899		Luxton, Thomas, B.A. and B.Sc. (Lond.), 116, North Boulevard, Hull

Date of
Election.

1908		Lyell, Henry Robert, F.I.C., A.K.C., Redcott, Dacres-road, Forest Hill, S.E.
1908		Lynch, Gerald Roche, M.B., and B.S. (Lond.), L.M.S.S.A., 17, Upper Addison-gardens, Holland Park, W.
1874		Lyon, John George, F.I.C., The Aire Tar Works, Knottingley, Yorks.
1886	Trans.	Lyons, Albert Brown, A.M. (Williams Coll.), M.D. (Mich.), 102, Algee-avenue, Detroit, Mich., U.S.A.
1888		Maben, Thomas, 20, Great Pulteney-street, W.
1896		Macadam, Herbert Edwin, Odam's Wharf, Victoria Docks, E.
1888		|| Macadam, Stevenson John Charles George, F.I.C., Analytical Laboratory, 55, York-place, Edinburgh
1899		McAlley, James, c/o Messrs. M. Cockburn and Co., Ltd., Gowan-bank Iron Works, Falkirk, N.B.
1903		Macara, Thomas, F.I.C., 20, Denton-road, Stroud Green, N.
1890		|| MacArthur, John Stewart, 74, York-street, Glasgow
1911	Trans.	McBain, James William, M.A. (Toronto), Ph.D. (Heidelberg), The University, and 71, Cotham-brow, Bristol
1910		McBeath, John William, Kimberley Mine Hospital, Kimberley, S. Africa
1913	Trans.	Macbeth, Alexander Killen, M.A. and B.Sc. (Q.U.I.), 3, Victoria-terrace, Cregagh, Belfast
1888		McBretncy, Edmund George, F.I.C., Newfield, Park-avenue, Castleford
1900		McCall, William, 13, Dargavel-avenue, Dumbreck, Glasgow
1902		MacCallum, Douglas Archibald, Central-chambers, 93, Hope-street, Glasgow
1913		McCann, John Francis, 2, Prince of Wales'-terrace, Sandymount-avenue, Ball's Bridge, B.O., Dublin
1905		McCleary, William, 61, Station-road, Pendlebury, near Manchester
1899		McClumpha, Robert, 372, Westgate-road, Newcastle-on-Tyne
1906	Trans.	McCombie, Hamilton, M.A. (Aberd.), B.Sc. (Lond.), Ph.D. (Strassburg), A.R.C.S., F.I.C., The University, Edgbaston, Birmingham
1907	Trans.	McConnan, James, D.Sc. (L'pool.), M.Sc. (Vict.), Ph.D. (Jena), 15, Grosvenor-road, Birkdale, B.O., Southport
1904		McCourt, Cyril Douglas, A.C.G.I., 45, Braxted-park, Streatham Common, S.W.
1896	Trans.	McCrae, John, jun., Ph.D. (Heidelberg), F.I.C., Government Laboratories, P.O. Box 1080, Johannesburg, S. Africa
1899		McCreath, William Dunlop, Quantock Vale Cider Co., Ltd., North Petherton, Bridgwater

Date of
Election.

1890		|| McCubbin, William Alexander, F.I.C., The Flax-yard, Little Neston, Chester
1897		MacCulloch, Charles, Bretton, Hamilton E., New Zealand
1894		McCutcheon, James, Meniehaus, Woodend-drive, Jordanhill, Glasgow
1903		Macdonald, David Baird, Krux Chemical Works, 33, Vulcan-road, Leicester
1901		Macdonald, F. G., Durban Roodeport Gold Mining Co., Ltd., P.O. Box 111, Roodeport, Transvaal, S. Africa
1912		Macdonald, James Leslie Auld, B.Sc. (St. Andrews), 13, Howard-place, St. Andrews
1894	Trans.	MacDonald, George William, M.Sc. (Melbourne), Whitefriars, Rochester
1906		Macdonald, Thomas, c/o Messrs. Hollingshurst and Co., Taj-Buildings, Hornby-road, Bombay, India
1891		MacDonald, William, A.R.C.S., A.R.S.M., F.I.C., Assistant Postal Secretary, Peking, China
1906		McDowall, John, c/o H. Monson, Esq., Sabaieh, Upper Egypt
1910		McEvelly, Thomas Patrick Cheetham, 114, St. George's-street, Durban, Natal, S. Africa
1886		MacEwan, Peter, 64, Southwood-lane, Highgate, N.
1895		MacFarlane, Alexander, Silver-street House, Dnnbar
1891		Macfie, Robert Andrew Scott, M.A. (Cantab.), B.Sc. (Edin.), 34, Moorfields, Liverpool
1910		MacGeorge, David Jackson, 13, Strand-road, Rangoon, Burma
1909		McGillvray, John Esson, M.A. (Edin.), 98, Sandwich-road, Tyne Dock, B.O. South Shields
1895		McGlashan, John, P.O. Balapur Tolodi, Tehsil Brahamapuri, Dist. Chanda, C.P., India
1887	Trans.	McGowan, George, Ph.D. (Leipzig), F.I.C., 21, Montpelier-road, Ealing, W.
1908		MacGregor, Gregor, M.A. and B.Sc. (Glas.), Sinclairtownbank, Kirkcaldy, Fife
1893		McGregory, Joseph Frank, Prof., Colgate University, Hamilton, N. Y., U.S.A.
1906		McIntosh, David, Diocesan Boys' High School, Rangoon, Burma
1890		Macintyre, Alfred Edgar, Ph.D. (Jena), The Chemical Laboratory, Dominion Arsenal, Quebec, Canada
1905		MacKechnie, Robert Drysdale, Mount Gerald, Larbert, Stirling-shire
1901	Trans.	C.1910-13 || McKenzie, Alexander, M.A. and D.Sc. (St. Andrews), Ph.D. (Berlin), Birkbeck College, Bream's Buildings, E.C.
1897	Trans.	Mackenzie, John Edwin, D.Sc. (Edin.), Ph.D. (Strassburg), 2, Ramsay-gardens, Edinburgh

Date of
Election.

1902		Mackenzie, John Ross, Worcester Brewery, Worcester
1899		|| Mackenzie, Thomas, 4, Church-street, Inverness
1900		Mackenzie, Thomas Ebenezer, 48, Willowbrae-road, Edinburgh
1893		McKerrow, Charles Alexander, 56, Ramillies-road, Bedford Park, W.
1897	Proc.	Maclaurin, James Scott, D.Sc. (N.Z.), Wellington, New Zealand
1868	Trans.	<div style="display: inline-block; vertical-align: middle;"> {C. 1871-4, 80-4, 95-9. V.P. 1887-90, 1901-04.} </div> || McLeod, Herbert, Prof., Hon. LL.D. (St. Andrews), F.R.S., 37, Montague-road, Richmond, Surrey
1899		McLeod, James, F.I.C., Gas Works, Greenock
1903		MacMahon, Frederick William, Netherhay, The Common, Warlingham, Whyteleafe, Surrey
1879		|| Macmillan, James Laker, 9, Wool-Exchange, MacQuarrie-place, Sydney, N.S.W.
1912		McMillan, William, c/o North Brazilian Sugar Factories, Ltd., Tiuna, Pernambuco, S. America
1889	Trans.	|| McMurtry, George Cannon, A.R.S.M., A.R.C.S., Templemore, Richmond, Nelson, New Zealand
1912		McMyn, James William, 35, Snowdon-road, Eccles
1880		Macnab, William, F.I.C., 10, Cromwell-crescent, S.W.
1885	Trans.	|| Macnair, Duncan Scott, Ph.D. (Würzburg), B.Sc. (Lond.), 67, Braid-avenue, Edinburgh
1913		Macnaughten, Duncan James, 31, Clonmel-road, Fulham, S.W.
1910		McNish, Malcolm, Shortsands, St. Neots
1913		Mahamadi, Ghulam Ali, B.A. (Bombay), c/o Messrs. Thomas Cook & Sons, Ludgate Circus, E.C.
1899		Main, Hugh, B.Sc. (Lond.), Almondale, Buckingham-road, South Woodford, N.E.
1900		Mair, William, 37, Morningside-drive, Edinburgh
1902	Trans.	Maitland, William, D.Sc. (Aberd.), Heriott-Watt College, Edinburgh
1910		Majima, Rikō, Prof., D.Sc. (Tokio), Chemical Institute, Imperial University, Sendai, Japan
1906		Majumdar, Tarak Nath, 37, Lower Chitpore-road, Calcutta, India
1894		Makin, Charles James Shaw, F.I.C., Thorn Bank, Leamington
1885	Trans.	|| Mallet, Frederic Richard, F.I.C., 20, King's-avenue, Ealing, W.
1897		Mallinson, Willie Lee, Gawthorp-green, Kirkheaton, near Huddersfield
1904		Mander, Alfred, Belle Vue House, Malvern
1903		Mander, Percy George, B.Sc. (Lond.), The Grammar School, Doncaster
1903		Mann, Ernest William, B.Sc. (Lond.), Lyndale, Northfield-road, King's Norton, Birmingham

Date of
Election.

1903		Mann, John Christopher, c/o Messrs. Robinson Bros., Ltd., Ryder's-green, West Bromwich
1902		Mann, William, B.Sc. (Lond.), 84, Inchmery-road, Catford, S.E.
1896		Manners, Hugh, M.A. and B.Sc. (Glas.), Academy House, Airdrie
1908		Mansfield, Herbert, B.Sc. (Lond.), F.I.C., 6, Aubrey-road, Crouch End, N.
1897		Mansford, Charles John Jodrell, B.A. (Lond.), The Grammar School, Dartford, Kent
1910		Marcen, Alexander, F.I.C., A.I.M.M., Royal Mint, Bangkok, Siam
1895		|| Marchant, Robert Charles, Salisbury-road, Andover
1905	Trans.	Marle, Ernest Robert, B.Sc. (Lond.), A.R.C.S., Hartley University College, Southampton
1907	Trans.	Marsden, Herbert, B.Sc. (Manc.), Bramford, Ipswich
1895		Marsden, Prosper Henry, The Royal Infirmary, Liverpool
1883	Trans. C. 1902-7	|| Marsh, James Ernest, M.A. (Oxon.), F.R.S., University Museum, Oxford
1895	Trans.	Marshall, Arthur, A.C.G.I., F.I.C., Waverley Cottage, Naini Tal, India
1891		Marshall, Reginald Tom, Kingscote, Upper Lenham-road, Sutton, Surrey
1887		|| Marshall, William, F.I.C., Laboratory, Ladybrook-road, Cheadle Hulme, Stockport
1897		Martin, Charles Henry, 50, Longmead-road, Claremont, Pendleton, Salford
1902		Martin, Francis, 3, York-terrace, Eglinton-road, Plumstead, S.E.
1906		Martin, Frederick James, Sungei Ayam, Kemaman, viâ Singapore, Straits Settlements
1911		Martin, Gaston Nilié, c/o South African Sugar Refineries, Ltd., South Coast Junction, Natal, S. Africa
1911	Trans.	Martin, Geoffrey, Ph.D. (Rostock), M.Sc. (Bristol), B.Sc. (Lond.), 4, Bertram-road, Hendon, N.W.
1906		Martin, George Frederick Wesley, 14, Castle-park, Lancaster
1898	Trans.	|| Martin, George Herbert, M.A. (Oxon.), The Grammar School, Bradford
1907		Martin, Gerald Hargrave, 22, Milestone-road, Upper Norwood, S.E.
1885		|| Martin, Gerald Ward, Lieut.-Col., 8, Petersham-terrace, Gloucester-road, S.W.
1913		Martin, Henry Stephen, 64, Dyke-road, Brighton
1901		Martin, Nicholas Henry, Ravenswood, Low Fell, Gateshead-on-Tyne
1910		Martin, William Ernest, 111, Bellevue-road, Berea, Durban, Natal, S. Africa

Date of
Election.

1903		Martin, William George, B.Sc. (Wales), Fellside, Hexham
1902		Martindale, William Harrison, Ph.D. (Marburg), 10, New Cavendish-street, W.
1871		|| Martineau, George, 21, Mincing-lane, E.C.; and Gomshall Lodge, Gomshall, Surrey
1887		|| Martineau, Sydney, Streatham-grove, Norwood, S.E.
1912		|| Masani, Nadirshaw Adarji, Prof., M.A. and B.Sc. (Bombay), Baroda College, Baroda Camp, India
1898		Mascarenhas, John Charles, Ph.D. (Coimbra), 27-28, King William-street, E.C.
1905		Mason, Arthur Walter, B.Sc. (Lond.), Norvic, Windsor-gardens, North Shields
1890		Mason, Francis Herbert, 3868, Florida-street, San Diego, Cal., U.S.A.
1882	Trans.	Masson, David Ormie, Prof., M.A. and D.Sc. (Edin.), F.R.S., The University, Melbourne, Australia
1910	Trans.	Masson, James Irvine Orme, M.Sc. (Melb.), University College, Gower-street, W.C.
1897		Masters, Edward, B.Sc. (Lond.), A.R.C.S., Rock Mount, 186, Hinckley-road, Leicester
1906		Mastin, John, M.A., D.Sc., Ph.D., Litt.D., LL.D., Woodleigh House, Totley Brook, near Sheffield
1909		Matchett, Andrew Sneddon, 13, Bute-gardens, Cathcart
1904		Mathews, Harold Joseph Clarke, Massey's Burnley Brewery, Ltd., Burnley, Lancs.
1902		Mathieson, Robert, J.P., Rill Bank, Innerleithen, Peeblesshire
1876	Trans.	|| Matthews, Charles George, F.I.C., Abendberg, 31, Stapenhill-road, Burton-on-Trent
1907		Matthews, Charles Pask, B.Sc. (Lond.), F.I.C., Tiffin's Boys School, Kingston-on-Thames
1880	Trans. C. 1900-09	|| Matthews, Francis Edward, Ph.D. (Göttingen), F.I.C., Ash Lawn, The Glebe, Blackheath, S.E.
1884		|| Matthey, Edward, Col., C.B., A.R.S.M., 31a, Weymouth-street, W.
1913		Maude, Aylmer Henry, A.I.C., Wadham House, Toynbee Hall, Commercial-street, E.
1893		|| Mawer, William Frederick, 27, Cathles-road, Balham, S.W.
1912		Maxwell, Francis, 77, Lawrie Park-road, Sydenham, S.E.
1913		Maxwell, Marius, 77, Lawrie Park-road, Sydenham, S.E.
1866		|| Maxwell, Theodore, B.A. and M.D. (Cantab.), F.R.C.S. (Edin.), B.Sc. (Lond.), 29, Woolwich Common, S.E.
1913		May, Joseph Horsnell, M.I.E.E., 21, Donovan-avenue, Muswell Hill, N.
1909	Trans.	May, Percy, B.Sc. (Lond.), 126, Cazenove-road, Stamford Hill, N.

Date of
Election.

1909		May, Rowland Josiah, Powerscroft, Grange-gardens, Southend-on-Sea
1913		Maynard, Harry Bertram, c/o Leo Taylor, Esq., 31, Moorgate-street, E.C.
1908		Maywald, Frederick John, 89, Pine-street, New York City, U.S.A.
1892		Meacham, Charles Stephen, c/o Messrs. Ohlsson's Cape Breweries, Ltd., Newlands, Cape Town, S. Africa
1912		Meadon, Percival Edward, M.A. (Oxon.), 6, Stanicy-road, Oxford
1898		Meads, Charles James, 21, Woodstock-road, Bedford Park, W.
1910	Trans.	Meanwell, Charles Wright, F.I.C., 15, Woodlands-crescent, Muswell Hill, N.
1904		Mears, Francis D'Oyley, jun., c/o The Campbell Ehrenfried Co., Ltd., Auckland, New Zealand
1901	Trans.	Mees, Charles Edward Kenneth, D.Sc. (Lond.), 3, Burke-terrace, Rochester, N.Y., U.S.A.
1908		Meggitt, Alfred Ash, B.Sc. (Lond.), Government of Eastern Bengal and Assam, Dacca, Eastern Bengal, India
1896		Meggitt, Loxley, F.I.C., c/o C.W.S., Ltd., W heatsheaf Works, Alexandria, Sydney, N.S.W.
1913		Mehta, Bhaichand Anupchand, M.A. (Bombay), c/o Messrs. Karsouji Mulchand, Rajkote, Kathiawad, India
1912		Meister, Frederick James, 1, Stanley-terrace, Alva, Clack-mannanshire
1871	Trans.	Meldola, Raphael, Prof., Hon. D.Sc. (Oxon.), Hon. LL.D. (St. Andrews), F.R.S., F.I.C., Finsbury Technical College, Leonard-street, E.C. ; and 6, Brunswick-square, W.C.
1905	Trans.	Meldrum, Andrew Norman, Prof., D.Sc. (Aberd.), College of Science, Ahmedabad, Bombay, India
1894		Melland, Godfrey, M.Sc. (Viet.), A.R.S.M., F.I.C., Chemical Department, The Polytechnic, Woolwich, S.E.
1908		Melling, Samuel Ernest, F.I.C., The Cliff, Higher Broughton, Manchester
1902	Trans.	Mellor, Joseph William, D.Sc. (N.Z.), The Villas, Stoke-on-Trent
1875		Melmore, Pattinson Banks, North How, Maryport
1902		Mence, George Augustus Henry, B.Sc. (Lond.), The Grammar School, Lincoln
1912		Menon, Ambat Kesava, B.A. (Madras), Chittur-Palghat, S. Malabar, Madras Presidency, India
1900	Proc.	Menzies, Alan Wilfrid Cranbrook, Prof., M.A. and B.Sc. (Edin.), Ph.D. (Chicago), Severance Chemical Laboratory, Oberlin College, Oberlin, Ohio, U.S.A.

C. 1883-
7, 90-91
F.S. 1891-
1902
V.P.
1902-05
P. 1905-7

Date of
Election.

1912			Menzies, Robert Charles, 12, South Bridge-street, St. Andrews
1889			Mercer, Thomas, F.I.C., Devonshire Club, Eastbourne
1901			Meredith, William, 63, Albion-place, Ulverston, Lancs.
1896			Merrett, William Henry, A.R.S.M., F.I.C., Hatherley, Grosvenor-road, Wallington, Surrey
1908			Merrick, Arnold, B.Sc. (Dun.), 66, Rothbury-terrace, Newcastle-on-Tyne
1891			Merrils, Frederick Johnson, Haxworth-chambers, 25, Figtree-lane, Sheffield
1911	Trans.		Merriman, Richard William, M.A. (Cantab.), 244, Victoria-park-road, South Hackney, N.E.
1897			Merson, George Fowlie, c/o Messrs. J. F. Macfarlan & Co., Abbey-hill Chemical Works, Edinburgh
1910	Trans.		Merton, Thomas Ralph, B.Sc. (Oxon.), 25, Gilbert-street, W.
1876	Trans.	{ C. 1884- S. 1897- 1901 V.P. 1906-9 }	|| Messel, Rudolph, Ph.D. (Tübingen), F.R.S., 147, Victoria-street, Westminster, S.W.
1909			Metzger, Floyd Jay, Columbia University, New York City, U.S.A.
1900			Meyer, Hans, Prof., Ph.D., German University, Prague, Austria
1904			Middleditch, Bernard, B.A. (Cantab.), 7, High-street, Harrow-on-the-Hill
1906			Middleton, Alexander Edmund, Government Laboratory, Clement's Inn-passage, Strand, W.C.
1912			Middleton, Herbert, M.Sc. (Manc.), Technical College, Bradford
1888	Trans.	{ V.P. 1901-04 }	|| Miers, Sir Henry Alexander, Principal, M.A. and D.Sc. (Oxon.), Hon. D.Sc. (Sheffield), Ph.D. (Christiania), F.R.S., 23, Wetherby-gardens, S.W.
1912			Milbourne, Robert John, Assoc.M.Inst.C.E., Muxton Lodge, Newport, Salop.
1908			Miles, William Herbert, c/o Messrs. H. A. Fowler & Co., 167, Vauxhall-road, Liverpool
1908			Millar, Charles James, c/o Messrs Turner, Morrison & Co., 6, Lyons-range, Calcutta, India
1892	Trans.		Millar, James Hill, D.Sc. (Birn.), F.I.C., Chief Chemist's Laboratory, St. James's Gate Brewery, Dublin
1891			|| Millard, Edgar James, 35-42, Charlotte-street, Great Eastern-street, E.C.
1905			Millen, John Dunlop, Mount Bischoff Mine, Waratah, Tasmania
1880	Trans.		|| Miller, Alexander Kenneth, Ph.D. (Würzburg), F.I.C., Kilvert's-buildings, Withy-grove, Manchester
1913			Miller, Arthur George Abraham, 1, Pretoria-terrace, Waltham Cross

Date of Election.		
1901		Miller, Edward Holl, c/o Messrs. Robert Harper & Co., Port Melbourne, Victoria, Australia
1889	Trans.	Miller, James Bruce, A.I.C., Rubislaw Den North, Aberdeen
1887		Miller, John Albert, M.Sc. (Illinois), Ph.D. (Berlin), 44 & 45, Lewis Block, Buffalo, N.Y., U.S.A.
1911		Miller, John Watterson, M.D. (Vict. and L'pool.), B.Ch. (Vict.), D.P.H. (Cantab.), Lynwood, Cantilupe-street, Hereford
1885	Trans.	|| Miller, Norman Harry John, Ph.D. (Würzburg), F.I.C., Harpenden, Herts.
1898		Miller, William Lash, B.A. (Toronto), Ph.D. (Munich), 50, St. Alban-street, Toronto, Canada
1893	Trans.	|| Mills, Charles, F.I.C., P.O. Box 112, Kroonstad, S. Africa
1862	Trans.	C. 1868-72, 75-6, 80-4, 1903-06 V.P. 1912- || Mills, Edmund James, Prof., D.Sc. (Lond.), LL.D. (Glas.), F.R.S., F.I.C., 64, Twyford-avenue, West Acton, W.
1906		
1911		Mills, Herbert Arthur, 3, Croxted-road, West Dulwich, S.E.
1898	Trans.	Mills, Robert, Plantation Nitolugt W.C., Demerara, British Guiana
1905	Trans.	Mills, William Hobson, M.A. (Cantab.), Sc.D. (Tübingen), Chemical Laboratory, The University, Cambridge
1885		Mills, William Sloan, M.A., D.Sc. and B.E. (R.U.I.), Chemical Dept., The Polytechnic, Woolwich, S.E.
1887		|| Milne, Alexander, Lieut.-Col. I.M.S., M.A., M.B. and M.Ch. (Aberd.), Morkew, Cults, Aberdeenshire
1887		Mingaye, John Charles Henderson, F.I.C., Department of Mines, Assay Branch, Sydney, N.S.W.
1898		|| Mitchell, Albert Henry, B.Sc. (Lond.), F.I.C., Borough Analyst's Laboratory, Hensleigh-road, Tiverton
1910	Trans.	Mitchell, Alec Duncan, B.Sc. (Lond.), 52, Montalt-road, Woodford Green
1907	Trans.	Mitchell, Herbert Victor, c/o The British Burma Petroleum Co., Ltd., 8-12, Spark-street, Rangoon, Burma
1910		Mitra, Dhirendranath, B.A. and B.L. (Shilpur), 89/2, Musjeed Bari-street, Calcutta, India
1905		|| Modi, Edalji Manekji, D.Sc. (N. Carolina), LL.D. (Tennessee), Litt.D. (Providence, Ohio), Meher-buildings, Tardeo, Bombay, India
1912		|| Modi, Pestanji Manekji, B.A. (Bombay), Meher-buildings, Tardeo, Bombay, India
1899		Mohr, Bernard, Ph.D. (Heidelberg), 69, Parliament-hill, Hampstead, N.W.
1901	Trans.	Moir, James, M.A. and D.Sc. (Aberd.), Chemical Laboratory, Mines Department, Plein-street, Johannesburg, S. Africa

Date of
Election

1893			Mole, Herbert Bloome, Royal Albert Brewery, Queen's-road, Reading
1902			Molesworth, Francis Hylton, Jersey-road, Artarmon, Sydney, N.S.W.
1899			Molson, John Cavendish, M.D. (Chicago), L.R.C.P. (Lond.), 17, Vernon-terrace, Brighton
1899			Mond, Emile Schweich, 22, Hyde-park-square, W.
1892			Mond, Robert Ludwig, M.A. (Cantab.), F.R.S.E., Combe Bank, near Sevenoaks.
1879			|| Mondy, Edmund Felix, Prof., A.R.S.M., Dacca, 96, Huron-road, Balham, S.W.
1903	Trans.		Monier-Williams, Gordon Wickham, M.A. (Oxon.), Ph.D. (Freiburg), F.I.C., 32, St. Leonard's-terrace, S.W.
1904			Montgomery, Jack Percival, Prof., Ph.D. (Virginia), A.M. (Clarksville), University of Alabama, University, Ala., U.S.A.
1887	Trans.	{ C. 1899- 1900 1905-8 }	|| Moody, Gerald Tattersall, D.Sc. (Lond.), F.I.C., Lorne House, North Dulwich, S.E.
1897			Moon, Philip George Gregory, Hillcroft, Alexandra-road, Upper Parkstone, Dorset
1892			|| Moor, Cresacre George, M.A. (Cantab.), F.I.C., Savoy House, 115, Strand, W.C.
1903			Moore, Alfred Ernest, B.A. and B.Sc. (Lond.), Escuela Normal Regional, Corrientes, Argentine, S. America
1903			Moore, Arthur, 128, Felbrigge-road, Goodmayes, Essex
1905	Trans.		Moore, Charles Watson, M.Sc. (Vict.), Ph.D. (Munich), c/o Messrs. J. Crosfield & Sons, Ltd., General Laboratory, Warrington
1891			Moore, Frederick Herbert, 87 and 89, Aldgate, E.
1910			Moore, Harold, M.Sc. Tech. (Mane.), 491, Buxton-road, Hazelgrove, Stockport
1907			Moore, John Edward Langford, Walton Cottage, Loughboro' Park, S.W.
1902			Moore, Thomas Henry, Holmfield, Windsor-road, Monkseaton, Whitley Bay, Northumberland
1904	Trans.		Moore, Tom Sidney, M.A. (Oxon.), B.Sc. (Lond.), Magdalen College, Oxford
1911	Trans.		Moore, Walter Roman, B.Sc. (Lond.), A.R.C.S., Kalimna, Garven-road, Stevenston, Ayrshire
1908			Morewood, Capel Darcy, Linden Cottage, Appleby, Doncaster
1895			Morgan, David James, M.A., M.D. and B.C. (Cantab.), D.P.H. (Lond.), 9, The Parade, Cardiff
1897			Morgan, Frederick Filmer de, 57, Woodberry-crescent, Muswell Hill, N.

Date of
Election.

1898	Trans.	{C. 1909-10 S. 1910-12 V.P. 1912-}	||Morgan, Gilbert Thomas, Prof., D.Sc. (Lond.), A.R.C.S., F.I.C., Royal College of Science for Ireland, Upper Merrion-street, Dublin
1908			Morgan, Howard Houlston, B.Sc. (Lond.), A.R.C.S., University College, Auckland, New Zealand
1888			||Morgan, John James, F.I.C., 14, Borough-road, Jarrow-on-Tyne
1900			Morgan, John Livingston Rutgers, Prof., A.M. and Ph.D. (Leipzig), B.Sc. (Rutgers College), Columbia University, New York City, U.S.A.
1912			Morgan, Sidney, Rubber Growers' Association Laboratory, Pata- ling, Kuala Lumpur, Federated Malay States
1880	Trans.		Moritz, Edward Ralph, Ph.D. (Göttingen), F.I.C., 45, Great Tower- street, E.C.
1879	Trans.	{C. 1887-90, 96-1900 }	||Morley, Henry Forster, M.A. and D.Sc. (Lond.), F.I.C., 5, Lynd- hurst-road, South Hampstead, N.W.
1909			Morley, William Norton, B.Sc. (Lond.), 356, Brownhill-road, Catford, S.E.
1912	Trans.		Morrell, George Francis, Ph.D. (Kiel), B.Sc. (Lond.), A.I.C., Sir John Cass Technical Institute, Jewry-street, Aldgate, E.C.
1895	Trans.		||Morrell, Robert Selby, M.A. (Cantab.), Ph.D. (Würzburg), c/o Messrs. Mander Bros., Wolverhampton; and Tor Lodge, Tettenhall Wood, Wolverhampton
1890			Morris, Arthur Higgs, 152, Chorley New-road, Bolton
1900			Morris, Edgar Ford, M.A. (Oxon.), c/o Cornbrook Chemical Co., Ltd., Newbridge Mills, Stockport, Cheshire
1905			Morris, Eric Haydn, Caixa Postal 175, Pernambuco, Brazil
1891			Morris, Joseph, Ph.D., Fern Bank, 8, Boardman-street, Eccles, Manchester
1905			Mortimer, Alfred, B.A. (Oxon.), Letchworth School, Letchworth, Herts.
1893			Morton, Frederick, Chemical Works, Milnsbridge, Huddersfield
1896			Moss, Francis Ambrose, Greenbushes, Western Australia
1871			||Moss, Richard Jackson, F.I.C., St. Aubyns, Ballybrack, Co. Dublin
1898			Moss, William Edward, Park Lodge, Princes-park, Liverpool
1886			||Moul, Frank, F.I.C., 5, Blakesley-avenue, Ealing, W.
1911			||Moullin, Oswald Mansell, M.A. (Cantab.), St. Martin's House, The College, Dover
1884			||Moyle, Robert Edward, M.A. (Oxon.), Heightley, Chudleigh, S. Devon
1859	Trans.	{C. 1863-6 F.S. 69-85 P. 85-7 }	||Müller, Hugo, Ph.D. (Göttingen), LL.D. (St. Andrews), Hon. D.Sc., (Manc.), F.R.S., 13, Park-square East, Regent's Park, N.W.

Date of
Election.

1909			Müller, John, B.A. (Cape of Good Hope), Government Analytical Laboratory, Cape Town, S. Africa
1909	Trans.		Müller, Robert, Ph.D. (Zürich), 19, Prinzregentenstrasse, Ludwigshafen am Rhein, Germany
1871	Trans.	C. 1890-4	|| Muir, Matthew Moncrieff Pattison, M.A. (Cantab.), Hillcrest, Farnham
1870			|| Muirhead, Alexander, D.Sc. (Lond.), F.R.S., The Lodge, Shortlands, Kent
1906			Mukerjee, Ram Chandra, Prof., B.A. (Allahabad), Maharaja's College, Jaipur, Rajputana, India
1913			Mumford, Ernest Joseph, 67, Hatherley-road, Walthamstow, N.E.
1912	Trans.		Mumford, Ernest Moore, M.Sc. (Manc.), 75, High-street, Chorlton-on-Medlock, Manchester
1907			Mummery, Charles Samuel, B.Sc. (Lond.), A.C.G.I., Central Technical College, South Kensington, S.W.
1906			Mummery, William Rest, F.I.C., c/o Establecimientos Argentinos de Bovril, Ltd., Santa Elena, Entre Rios, Argentine, S. America
1902			Mundey, Alfred Holley, 14, Wrottesley-road, Plumstead, Kent
1876	Trans.		|| Munro, John May Herbert, D.Sc. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), F.I.C., 12, Grosvenor-place, Bath
1888			Munroe, Charles Edward, Prof., George Washington University, Washington, D.C., U.S.A.
1900			Munton, Frederick Thomas, Craigmere, Winsford, Cheshire
1910			Murch, Douglas Wilshin, 123, Derby-street, Burton-on-Trent
1907			Murgatroyd, Louis, 1, Carlton-drive, Heaton, Bradford
1901			Murphy, Albert John, 3 and 4, Queen-square, Leeds
1913			Murphy, Paul, F.I.C., Burnside, Sidcup, Kent
1904			Murray, Benjamin Lindley, A.M. (Columbia), B.S. (Mich.), e/o Messrs. Merck & Co., Manufacturing Chemists, Rahway, N.J., U.S.A.
1906			Murray, Thomas Jenkins, M.Sc. (Birm.), Ph.D. (Leipzig), Municipal Technical School, Wolverhampton
1890	Trans.		|| Murray, Thomas Smith, D.Sc. (Edin.), 27, Shamrock-street, Dundee
1869			|| Muspratt, Edmund Knowles, Hon. LL.D. (L'pool.), F.I.C., Seaforth Hall, near Liverpool
1873			|| Muspratt, Sidney Knowles, 9, Church-street, Flint, N. Wales
1896			Muter, Alexander Henry Mitchell, F.I.C., Laboratory, 325, Kennington-road, S.E.; and The Châtelet, Horley, Surrey
1912			Myers, Ernest Meyer, Sharrow, Basford-park, Stoke-on-Trent
1910	Trans.		Myers, James Eckersley, B.Sc. (Manc.), Acresfield, Gatley, Cheshire

Date of
Election.

1892	Trans.	Myers, William Shields, D.Sc. (N.J.), M.Sc. (New Brunswick), B.Sc. (Rutgers Coll.), 17, Madison-avenue, New York City, U.S.A.
1887		Nagel, David Henry, M.A. (Oxon.), Trinity College, Oxford
1910		Nair, Valliyil Govindan, B.A. (Madras), M.Sc. Tech. (Manc.), Parpanangadi, Malabar, Madras Presidency, India
1903		Nairne, Urban Orlando Scotchburn, 1, Eglantine-road, Wandsworth, S.W.
1874		|| Napier, Arthur Sampson, Prof., B.Sc. (Oxon.), c/o Herren Mayer and Müller, 2, Prinz Louis Ferdinandstrasse, Berlin
1893		Napier, John Watson, Corporation Gas Works, Alloa
1909		Napier, Thomas, c/o Tho Cassel Cyanide Co., Ltd., Maryhill, Glasgow
1900	Trans.	Napper, Sidney Scrivener, A.C.G.I., A.I.C., c/o Messrs. S. Courtauld and Co., Ltd., Foleshill-road, Coventry
1910		Narbeth, Benjamin Mason, B.Sc. (Wales), Technical Institute, Russell-street, Durban, Natal, S. Africa
1898		Nash, Leonard Myddelton, F.I.C., 3, Princess-road, Finsbury Park, N.
1911		Nath, Bhāgavatula Viswa, Agricultural College and Research Institute, Coimbatore, India
1912		Natrajan, Tanjore S., Prof., Bishandarkoil, P.O., Srirangam, Trichinopoly, India
1912	Trans.	Naunton, William Johnson Smith, B.A. (Cantab.), B.Sc. (Lond.), 1, New-street, Woodbridge; and The Wellcome Chemical Research Laboratories, 6, King-street, Snow Hill, E.C.
1900		Naylor, Ernest Brooks, M.Sc. (Vict.), F.I.C., Eversleigh, Gathurst, Wigan
1913	Trans.	Naylor, Jonathan Harold, M.Sc. (Manc.), A.I.C., Lindene, Peelhouse-lane, Widnes
1891		Naylor, William, 3, Garstang-road, Fulwood-park, Preston
1878	Trans.	Naylor, William Arthur Harrison, F.I.C., The British Drug House, Ltd., 22-30, Graham-street, City-road, N.
1910		Neal, George William, B.Sc. (Lond.), 8, Little Park-gardens, Enfield, Middlesex
1908		Neech, Herbert Richard, Doddington-road, Swallowbeck, Lincoln
1910		Needs, Francis Edwin, 7, Effingham-road, St. Andrew's-Park, Bristol
1898		Neilson, Alexander MacGillivray, Umbilo Post Office, via Durban, Natal, S. Africa
1912		Neilson, Richard Gillies, c/o Burma Oil Co., Ltd., P.O. Box 67, Rangoon, Burma

Date of Election.		
1908	Trans.	Neogi, Punchānan, Prof., M.A. (Calcutta), Rajshahi College, Rajshahi, Eastern Bengal and Assam, India
1901		Neumann, Edgar David Maurice, M.A. (Oxon.), Ph.D. (Göttingen), A.I.C., 7 & 8, Idol-lane, E.C.
1871	Trans.	||Nevill, Edmund Neville, F.R.S., F.I.C., 59, Enys-road, Eastbourne
1890	Trans.	Neville, Francis Henry, M.A. (Cantab.), F.R.S., La Verna, Letchworth, Hitchin
1905	Trans.	Neville, Henry Allen Dugdale, B.A. (Cantab.), B.Sc. (Lond.), F.I.C., 11, de Freville-avenue, Chesterton-road, Cambridge
1892		||Newall, John Fenton, St. James's-buildings, Oxford-street, Manchester
1885		||Newbolt, Francis George, M.A. (Oxon.) Balliol College Laboratory, Oxford
1891		||Newlands, William Peter Reina, 10, Cricklade-avenue, Streatham Hill, S.W.
1912		Newman, Leslie Frank, B.A. (Cantab.), Downing College, Cambridge
1910	Trans.	Newman, Sidney Herbert, B.Sc. (Lond.), Springfield Brewery, Wolverhampton
1889		Newsholme, George Thomas Wilkinson, 27, High-street, Sheffield
1894	Trans.	Newth, George Samuel, F.I.C., The Sheiling, Godstone, Surrey
1895		Newton, Charles Butterworth, M.Inst.C.E., Town Hall, Hull
1911		Newton, Leonard Owen, 41, Bennett-park, Blackheath, S.E.
1899	Trans.	Nicholls, William Walter Scott, B.Sc. (Lond.), c/o Mrs. Tyrrell, 8, Foxwell-street, Brockley, S.E.
1912		Nicholls, William Moore, 17, Ferrybridge-road, Castleford
1870	Trans.	||Nicholson, Edward, Brigade Surgeon, Lieut.-Col., M.R.C.S. (Eng.), L.S.A. (Lond.), D.P.H. (Cantab.), F.I.C., 111, Avenue de Neuilly, Neuilly-sur-Seine, Paris, France
1910		Nicholson, Philip Brady, Doneaster-road, Thrybergh, Rotherham
1889		Nickels, Wallace Christopher, 41, Cheapside, E.C.
1892		Nickolls, John Bate, The Exchange, Malvern
1883	Trans.	Nicol, William Walker James, M.A. and D.Sc. (Edin.), F.I.C., 15, Blacket-place, Edinburgh
1912	Trans.	Nierenstein, Maximilian, Ph.D. (Berno), 30, Cavendish-road, Henleaze, Bristol
1900		Nightingale, Thomas Marginson, B.Sc. (Vict.), 117, High-street, Bolton
1898		Nightseales, Thomas Arthur, 642, Holderness-road, Hull
1894		Nixon, Alfred, 7, Oak-road, Sale, Manchester
1869		Noble, Sir Andrew, Bart., K.C.B., D.C.L. (Dun.), F.R.S., Jesmond Dene House, Newcastle-on-Tyne

Date of Election.		
1913	Trans.	Nolan, Thomas Joseph, M.Sc. (Dub.), 32, Newmarket, Dublin
1903	Trans.	Norman, George Marshall, B.Sc. (Lond.), A.R.C.S., F.I.C., 135, Walmersley-road, Bury
1889		Norman, John Thomas, 23, Leadenhall-street, E.C.
1908		Normand, Alexander Robert, M.A. and B.Sc. (Edin.), Wilson College, Bombay, India
1892		Norris, Charles James, 31, Airedale-avenue, Chiswick, W.
1909	Trans.	Norris, Roland Victor, M.Sc. (Manc.), A.I.C. 16, Roseneath-road, Clapham Common, S.W.
1897	Trans.	North, Barker, 33, Ashgrove, Great Horton-road, Bradford
1892		Northing, John, The Murrrough, Wicklow
1878		||Norton, Thomas Herbert, Prof., Ph.D. (Heidelberg), D.Sc. (Hamilton), c/o The American Consulate, Theaterstrasse, 14, Chemnitz, Saxony, Germany
1912		Nowak, Carl Alfred, B.Sc. (Chicago), 2739, Mildred-avenue Chicago, Ill., U.S.A.
1901		Nunn, Arthur William, 57, Crouch-street, Colchester
1907	Trans.	Nuttall, Walter Harold, F.I.C., Trafoi, Albert-road, Watford
1904		Oakden, William Edward, 2, Gledhow-terrace, S. Kensington, S.W.
1910		Oakley, Robert O'Field, c/o The Patent Office, 25, Southampton-buildings, Chancery-lane, W.C.
1893	Trans.	Oates, William Henry, Townhead, Dore, Sheffield
1907		Oberländer, Otto, Ph.D. (Heidelberg), 29, Queen-street, E.C.
1903		O'Brien, Frederick, M.Sc. (L'pool.), Lynwood, Bishopsworth, Bristol
1890		Oddy, Robert Walter, F.I.C., Waterhouse, Toad-lane, Rochdale
1873		||Odling, Walter, F.I.C., c/o Messrs. Bass and Co., Burton-on-Trent
1848	Trans.	Odling, William, Prof., M.A. (Oxon.), M.B. and F.R.C.P. (Lond.), Hon. Ph.D. (Leyden), F.R.S., F.I.C., 15, Norham-gardens, Oxford
1905		||O'Farrelly, Alfons, M.A. (R.U.I.), 58, Upper Leeson-street, Dublin
1912		Ogilvie, James Pettigrew, Homedale, Hendon-lane, Church End, Finchley, N.
1908		||Oke, Alfred William, B.A. and LL.M. (Cantab.), 32, Denmark-villas, Hove, Sussex
1909		Okell, Frederick Leigh, F.I.C., c/o Straits Trading Co., Ltd., Singapore, Straits Settlements
1908		Okell, Stanley Allen Warrington, c/o The Industrial Chemical Co., 200, Fifth-avenue, New York City, U.S.A.
1901		Oldershaw, William, J.P., The Firs, Kimberley, Nottingham

S. 1856-69
V.P.
1869-73
P. 1873-5

Date of
Election.

1904			Oldfield, Laurel Cecil Francis, 5, Pump-court, Temple, E.C.
1913			Oliver, Ralph Richard, c/o The Southern Fibre Co., Portsmouth, Va., U.S.A.
1889			O'Mahony, Daniel John, Municipal-buildings, Cork
1912			|| O'Mara, James, B.A. (R.U.I.), Dunlca, College-road, Dulwich, S.E.
1901			Oram, Frank, Market-place, Romsey
1912			Orange, Lionel, B.Sc. (Lond.), 148, Barkworth-road, N. Cam- berwell, S.E.
1890	Trans.		Ormandy, William Reginald, D.Sc., 53a, Barton-arcade, Man- chester
1872			|| Ormerod, Joseph Arderne, M.D. (Oxon.), M.R.C.S. (Eng.), F.R.C.P. (Lond.), The Library, St. Bartholomew's Hos- pital, E.C.
1887			|| Ormiston, Archibald Reid, Braeholm, Helensburgh; and 213, St. Vincent-street, Glasgow
1893			Orr, Alexander, 80, Hunter-street, Sydney, N.S.W.
1881			Orr, John Bryson, Crossacres, Much Woolton, Liverpool
1897	Trans.	C. 1913-	|| Orton, Kennedy Joseph Previté, Prof., M.A. (Cantab.), Ph.D. (Heidelberg), F.I.C., Llwyn Eithin, and University College of North Wales, Bangor
1881	Trans.		O'Shea, Lucius Trant, M.Sc. (Sheffield), B.Sc. (Lond.), The University, Sheffield
1887			Ostersetzer, Julius, F.I.C., c/o Messrs. W. and H. M. Goulding, Manure Manufacturers, North Wall, Dublin
1883	Trans.		O'Sullivan, James, F.I.C., High Bank, Burton-on-Trent
1899			O'Sullivan, John, 1649, Barelay-street, Vancouver City, British Columbia
1887			|| O'Sullivan, Patrick Thomas, M.D. and B.Ch. (R.U.I.), 20, South Mall, Cork
1891			Ough, Lewis, Fernleigh, St. James's-road, Leicester
1888			Overbeck, Otto Christoph Joseph Gerhard Ludwig, Chantry House, Great Grimsby
1887			|| Overend, Frederick Lawrence, B.A. (Oxon.), Lyndhurst, Leigh- road, Walsall
1911			Owen, Idris Larkby, 101, Floyer-road, Small Heath, Birmingham
1911	Trans.		Page, Harold James, B.Sc. (Lond.), 163, West-road, Westcliff- on-Sea, B.O., Southend-on-Sea
1913			Paget, Ferrand, c/o The Bombay Burmah Trading Corporation, Ltd., Bangkok, Siam
1909			Painter, Frederick Hubert, B.Sc. (Lond.), 29, Talbot-road, Winton, Bournemouth

Date of
Election.

1912		Painter, George Macaulay, B.Sc. (Lond.), The Grammar School, Eye, Suffolk
1884		||Pallister, John William, B.Sc. (Lond.), 107, Waverley-road, Bradford
1910		Palmer, Gilbert, B.Sc. (Lond.), 5, Welldock-road, West Hartlepool
1888		Palmer, Henry John, Standon, Bridestowe, Devon
1899		Palmer, Thomas Henry, c/o Broken Hill Junction North Silver Mining Co., P.O. Box 98, Broken Hill, N.S.W.
1912	Trans.	Paniker, Ramni, M.A. (Madras), M.Sc. (Leeds), Con-ejo de Ciento, 288, Barcelona, Spain
1902		Panisset, Sydney Glyde Stephen, Lyme Villa, Cherry Hinton, Cambridge
1899	Trans.	Panting, Laurence Christopher, M.A., M.D. and B.Ch. (Oxon.), 45, Lemon-street, Truro
1910		Paris, Edward Talbot, 15, Montpellier-villas, Cheltenham
1898		Parker, Alfred James, 1, Bulwer-street, Herne Bay, Auckland, New Zealand
1897		Parker, Charles Henry, c/o Messrs. James Simmonds & Co., Ltd., Rose Cottage Works, Whitmore Reans, Wolverhampton
1913		Parker, Jonathan, c/o The Wattle Extract Co., 42, Anglo-African House, Durban, Natal, S. Africa
1882		Parker, Joseph Richard, Ranston, 119, Cazenove-road, Stamford Hill, N.
1894	Trans.	Parker, Matthew Archibald, Prof., B.Sc. (Glas.), University of Manitoba, Winnipeg, Canada
1882		||Parker, Robert Henry, Ravenscar, Orchard-road, Blackheath, S.E.
1901		Parkes, Albert Edward, F.I.C., Chemical Laboratory, 43, Whitehorse-street, Stepney, E.
1912	Trans.	Parkes, John Wilfrid, 14, Gower-terrace, Willenhall, Staffs.
1911		Parkes, Thomas Peers, B.Sc. (Lond.), 22, Dalrymple-road, Brockley, S.E.
1906		||Parkin, John, M.A. (Cantab.), Blaithwaite, Carlisle
1865	Trans.	||Parkinson, James, Queen's-chambers, Pirie-street, Adelaide, S. Australia
1893		||Parrish, Samuel, B.Sc. (Lond.), 80, Grange-avenue, Chapel-town-road, Leeds
1892		Parry, Ernest John, B.Sc. (Lond.), F.I.C., Thanet House, 56A, Great Dover-street, S.E.
1903	Trans.	Parry, William, B.Sc. (Lond.), Incowood, Waterloo-park, Liverpool
1911		Partington, Edward, Oakdene, Sedgley-park, Manchester
1911		Pastfield, John Lawrence Robinson, Rev., B.A. (Oxon.), Ivanhoe, Dendie-road, Paignton

Date of
Election.

1894	Trans.	Paterson, David, F.R.S.E., Lea Bank, Rosslyn, Midlothian
1910		Paterson, John Hamilton, M.Sc. (Dundee), Armstrong College, Newcastle-on-Tyne
1885	Trans.	Patterson, George, F.I.C., 20, Madrid-road, Castelnau, Barnes, S.W.
1912		Patterson, John William, 23, Ferndene-road, Herne Hill, S.E.
1896		Patterson, Joseph William, 56, Grange-road, West Hartlepool, Durham
1870	Trans.	Patterson, Thomas Law, F.I.C., Maybank, Finnieston-street, Greenock
1904	Trans.	Patterson, Thomas Stewart, D.Sc. (Lond. and Glas.), Ph.D. (Heidelberg), Chemical Department, The University, Glasgow
1868	Trans.	|| Paul, Benjamin Horatio, Ph.D. (Giessen), Parkside, Kingston Vale, Putney, S.W.
1911		Paul, Felix Gabriel, 64, 38th-street, Rangoon, Burma
1885	Trans.	Paul, Lewis Gordon, Ph.D. (Tübingen), F.I.C., Market Hall- chambers, King-street, Huddersfield
1896		Payne, Arthur, c/o Messrs. Mawson and Swan, Moseley-street, Newcastle-on-Tyne
1893		Payne, George Frederick, M.D. (Atlanta), 63, Armstrong-street, Atlanta, Georgia, U.S.A.
1899	Trans.	Peachey, Stanley John, M.Sc. (Manc.), School of Technology, Sackville-street, Manchester
1901		Peacock, Arthur, B.Sc. (Vict.), The Brebner Schools, Bloemfont- tein, S. Africa
1911	Proc.	Peacock, David Henry, B.A. (Cantab.), B.Sc. (Lond.), A.I.C., Gowanlea, Caledonia-road, Saltcoats, Ayrshire
1900		Pearce, Ernest Vivian, c/o Transvaal Consolidated Lands, Ltd., Groenfontein Mine, Potgietersrust, Transvaal, S. Africa
1874		Pearce, William, M.P., Chemical Works, Bow Common, E.
1908		Pearson, George Edward, c/o Messrs. Burroughs, Wellcome & Co., Snow Hill Buildings, E.C.
1912		Pearson, George Ernest, Prospect Cottage, Sutton, near Hounslow
1908		Pearson, John William, B.A. (Cantab.), 35, Orford-road, Warrington
1894	Trans.	Pearson, William Henry, Suffolk House, Cannon-street, E.C.
1902		Peck, John Wicliffe, 13, Springwell-avenue, Harlesden, N.W.
1911	Trans.	Peddle, Cyril James, M.Sc. (Sheffield), 146, Barnsley-road, Cudworth, Barnsley
1894		Peden, John, Chemical Laboratory, 11, Duff-street, Greenock
1870	Trans.	{ V.P. } || Pedler, Sir Alexander, Prof., C.I.E., F.R.S., F.I.C., 28, Stanhope- 1907-10 } gardens, Queen's Gate, S.W.
1904		Pell, Alfred, 44, Cumballa-hill, Bombay, India

Date of Election.		
1886	Proc.	Pendlebury, William Henry, M.A. (Oxon.), Broadlands, Canonbury, Shrewsbury
1905		Penn, Francis Richard, B.Sc. (Lond.), A.R.C.S., 11, Crawshaw-avenue, Pudsey, Leeds
1870		Penney, Mulgrave Daniel, 11, High-street, Hull
1910		Pennington, Alfred John, Oakley, Fallowfield, Manchester
1895		Pennington, William Henry, Westgate, Longley-road, Worsley
1886		Pentecost, Stephen James, Lenton Works, Nottingham
1911		Percival, George Arncliffe, 45, Hungerford-road, N.
1884	Trans.	C. 1906-10 Perkin, Arthur George, Prof., F.R.S., F.I.C., The University, and Grosvenor Lodge, Grosvenor-road, Leeds
1891	Trans.	|| Perkin, Frederick Mollwo, Ph.D. (Würzburg), F.I.C., 199, Piccadilly, W.
1884	Trans.	$\left\{ \begin{array}{l} \text{C.} \\ 1891-5 \\ \text{V.P.} \\ 1906-9 \\ \text{P.} \\ 1913- \end{array} \right\}$ † Perkin, William Henry, Prof., Ph.D. (Würzburg), Hon. Sc.D. (Cantab.), Hon. LL.D. (Edin. and St. Andrews), F.R.S., F.I.C., 5, Charlbury-road, Oxford
1906	Proc.	Perkins, William Hughes, B.Sc. (Manc.), The University, Leeds
1890	Trans.	|| Perman, Edgar Philip, D.Sc. (Lond.), University College, Cardiff
1905		Perrott, Bert, Bryn Clydach, Neath Abbey, Neath
1908		Perry, Frank, Shrubbery-place, Bloomfield, Tipton
1900		Pettigrew, Robert, 44, Mosley-street, Manchester
1902	Trans.	Phelps, John, M.A. (Oxon.), The Royal Mint, E. ; and Newcroft, Egmont-road, Sutton, Surrey
1881		Philip, Arnold, B.Sc. (Lond.), A.R.S.M., F.I.C., Chemical Laboratory, H.M. Dockyard, Portsmouth
1897	Trans.	$\left\{ \begin{array}{l} \text{C.} \\ 1910-13 \\ \text{S.} \\ 1913- \end{array} \right\}$ Philip, James Charles, M.A. and D.Sc. (Aberd.), Ph.D. (Göttingen), Imperial College of Science and Technology, S Kensington, S.W., and 17, Fairfax-road, Bedford Park, W.
1904		Phillips, George Frederick Tyler, B.Sc. (Lond.), University College, Southampton
1897	Trans.	Phillips, Harry Edward William, M.A. and B.Sc. (Oxon.), Church House, Summertown, Oxford
1882		Phillips, Henry Harcourt, Lynwood, Turton, Lancs.
1902	Trans.	|| Phillips, Percy Philip, Ph.D. (Göttingen), Thomason Engineering College, Rurki, U.P., India
1908		Phillips, Thomas Richard, 5, Enmore-road, Putney, S.W.
1905		Phipson, Percy Barker, c/o Messrs. J. Staples and Co., Ltd., Wellington, New Zealand
1909	Trans.	Pickard, Joseph Allen, B.Sc. (Lond.), A.R.C.S., Dundee, Upton-road, Bexley Heath, Kent
1897	Trans.	|| Pickard, Robert Howson, D.Sc. (Lond.), Ph.D. (Munich), B.Sc. (Birm.), F.I.C., Municipal Technical School, Blackburn

† Longstaff Medallist, 1900.

Date of
Election.

1891		Pickering, Michael Samuel, B.Sc. (Lond.), 38, Price-street, Burslem	
1878	Trans.	{ C.1886-7, 89-93, 1901-04. }	|| Pickering, Spencer Percival Umfreville, M.A. (Oxon.), F.R.S., F.I.C., Harpenden, Herts.
1906	Trans.		Pickles, Samuel Shrowder, D.Sc. (Vict.), c/o Messrs. George Spencer, Moulton & Co., Ltd., Bradford-on-Avon
1890	Trans.		|| Picton, Harold, B.Sc. (Lond.), The Thatch, Ugley-green, Bishop's Stortford
1909	Trans.		Picton, Norman, B.Sc. (Wales), Ph.D. (Leipzig), 31, South Beach-avenue, Ardrossan
1874	Trans.		|| Pike, William Herbert, Prof., Ph.D. (Göttingen), Sandhills, Salcombe, Devon
1883			|| Pilley, John J., Ph.D., 167, Camberwell-grove, S.E.
1896			Pilley, Thomas William, 33, Grove-hill-road, Denmark Hill, S.E.
1889			Ping, William, 14, Selsdon-road, Wanstead, N.E.
1908			Pingriff, George Neville, B.A. Cantab.), The Grammar School, Market Bosworth, Nuneaton
1889			|| Pingstone, George Arthur, P.O. Box 445, Bulawayo, S. Africa
1904			Pinkerton, David John, Dalzell Steel and Iron Works, Motherwell
1908			Pinnock, Douglas Robert, A.C.G.I., c/o The Nucoa Butter Co., 4th-Street and Avenue A, Bayonne, N.J., U.S.A.
1881			Pisani, Orestes Victoriano, 188, Cavendish-road, Clapham Park, S.W.
1903	Trans.		Pitt, Arthur Ernest, Broad View, Chigwell-road, South Woodford, N.E.
1903			Pitt, Harold Russell, 240, Burrage-road, Plumstead, S.E.
1911			Pitt, Leonard Ison, B.Sc. (Lond.), The School, Stamford
1882			|| Pitt, Theophilus, Highleigh, Sidlesham, Chichester
1899			Pittuck, Frederick Williams, 19, Stratford-grove, Heaton, Newcastle-on-Tyne
1899			Pizey, James Henry, A.R.C.S., F.I.C., 45, South-road, Smethwick, Birmingham
1893			Platt, Charles, M.D., Ph.D., Hamilton-court, 39th and Chestnut-streets, Philadelphia, U.S.A.
1911			Plews, Frank Henry, 28, Gollatly-road, St. Catherine's Park, S.E.
1899	Trans.		|| Plimmer, Robert Henry Aders, D.Sc. (Lond.), 59, Queen's-road, St. John's Wood, N.W.
1907			Pochin, Harold, M.A. (Cantab.), Municipal Technical School, Sutton Coldfield, Birmingham
1913			Pollard, Cornelius Theodore, B.Sc. (Sheffield), 21, Wharnccliffe-road, Broomhall Park, Sheffield

Date of Election.		
1888		Pollard, Frederick Ernest, F.I.C., 14, Old Hall-street, Hertford
1898	Trans.	Pollard, William, M.A. (Cantab.), D.Sc. (Tübingen), F.I.C., The Museum, Jermyn-street, S.W.
1903		||Pollard, William Branch, B.A. (Cantab.), Laboratory-buildings, Public-works-gardens, Cairo, Egypt
1902		Pollitt, George Paton, B.Sc. (Vict.), Ph.D. (Bâle), Winnington, Northwich, Cheshire
1901		Pollitt, James Charles Tomlin, 7, Grosvenor-road, Handsworth, Birmingham
1896		Pollitt, Robert Barnabas, F.I.C., c/o J. Manning Prentice, Esq., Solicitor, Stowmarket
1894	Trans.	||Pollok, James Holms, D.Sc. (Glas.), Royal College of Science, Stephen's-green, Dublin
1903		Pond, George Gilbert, Prof., M.A. and Ph.D. (Amherst), State College, Pennsylvania, U.S.A.
1890		Pond, James Alexander, Auckland, New Zealand
1909	Trans.	Pope, Frank George, 28, Alcester-crescent, Upper Clapton, N.E.
1912	.	Pope, Rupert William, B.Sc. (Lond.), A.I.C., 10, Malpas-road, Brockley, S.E.
1898	Trans.	Pope, Thomas Henry, B.Sc. (Birm.), A.C.G.I., F.I.C., Brewing School, The University, Birmingham
1891	Trans.	(C. 1900-2) †||Pope, William Jackson, Prof., M.A. (Cantab.), M.Sc. (Manc.), (V.P. 1911-) Hon. LL.D. (St. Andrews), F.R.S., F.C.G.I., F.I.C., Chemical Laboratories, The University, and Holmesdale, Brooklands-avenue, Cambridge
1906		Porritt, Benjamin Dawson, B.Sc. (Lond.), F.I.C., c/o Miss Laing, 62, Queen-street, Edinburgh
1903		Porter, Robert James, B.Sc. (Lond.), 11, Arlington-street, Hull
1884	Proc.	||Porter, Thomas Cunningham, M.A. and D.Sc. (Oxon.), Upton-park, Slough; and Eton College, Windsor
1904		|Porter, Thomas Linton Daniel, B.Sc. (Lond.), 162, Coventry-road, Ilford, E.
1910		Posford, Benjamin Ashwell, Wood Dene, Kippington, Sevenoaks
1883		Potter, Charles Edward, c/o Messrs. Tate and Sons, Love-lane Sugar Refinery, Liverpool
1912	Trans.	Potter, Charles Etty, B.Sc. (Manc.), 9, Church-view, Church-lane, Heckmondwike, Yorks.
1913		Potter, Francis Martin, B.Sc. (Lond.), A.R.C.S., A.I.C., 6, Stavordale-road, Highbury, N.
1912		Potter, Howard Vincent, 35, St. Helen's-crescent, Hastings
1896		Potts, Henry William, Hawkesbury Agricultural College, Richmond, N.S.W.

† Longstaff Medallist, 1903.

Date of
Election.

1913		Pougnet, Julien Pierre Frederic, Natal Sugar Estates, Ltd., Mount Edgecombe, Natal, S. Africa
1884		|| Power, Francis Reginald, The Royal Mint, Melbourne, Australia.
1896	Trans.	Power, Frederick Belding, Ph.D. (Strassburg), Hon. LL.D. (Wisconsin), 6, King-street, Snow-hill, E.C.
1908		Power, George O'Brien, Assistant Opium Agent, Basti, B.N.W. Railway, India
1910		Prasad, Hari, Prof., B.A. (Punjab), B.Sc. (Manc.), Victoria College, Lash Kar, India
1904	Trans.	Prentice, Bertram, Ph.D. (Munich), D.Sc. (Edin.), Royal Technical Institute, Salford
1910		Preston, Knowles, 48, Queen's-road, Twickenham
1902		Pribram, Richard, Hofrat Prof. Dr., Horlgasse 9, Vienna IX., Austria
1882		|| Price, Arthur Faraday, 2503, Broadway, San Francisco, Cal. U.S.A.
1899		Price, Robert Coleman, Prof., The Miller School, P.O., Albemarle Co., Va., U.S.A.
1901	Trans.	Price, Thomas Slater, D.Sc. (Lond. and Birm.), Ph.D. (Leipzig) F.I.C., Chemical Department, Municipal Technical College, Suffolk-street, Birmingham
1903		Prichard, George Montague, c/o Messrs. Smith, Stannistreet & Co., 9, Dalhousie-square, Calcutta, India
1889		|| Priestley, Charles William, B.Sc. (Lond.), A.R.C.S., Richmond Lodge, Torquay
1871	Trans.	|| Procter, Henry Richardson, Prof., Hon. M.Sc. (Leeds), F.I.C., The University, Leeds; and Rowangarth, Ben Rhydding, viâ Leeds
1889	Trans.	Proctor, Charles, F.I.C., 118, Grosvenor-road, Westminster, S.W.
1909		Proud, Charles, 12, Chancellor-road, Southend-on-Sea
1882		|| Pullar, Rufus Daniell, Brahan, Perth
1902		Puntan, Herbert Harding Cruikshank, Borough Analyst's Office, London-chambers, Durban, Natal, S. Africa
1875	Trans.	{ C 1888- 92 } Purdie, Thomas, Emeritus Prof., Ph.D. (Würzburg), Hon. { V.P. 1899- 1902 } LL.D. (Aberd.), B.Sc. (Lond.), F.R.S., A.R.S.M., F.I.C., The University, St. Andrews
1901	Trans.	Purvis, John Edward, M.A. (Cantab.), A.R.C.S.I., F.I.C., University Chemical Laboratory, Cambridge
1906		Pye, Thomas Ebenezer, Clovelly, Chichester, Sussex
1886		Pyke, Lazarus Simon Magnus, Assoc. M. Inst. C.E., M. Inst. E.E., 10, Westbourne-terrace, Hyde Park, W.
1905	Trans.	Pymon, Frank Lee, D.Sc. (Vict.), Ph.D. (Bâle), Carlee, Selborne-road, Sidcup, Kent
1905		Quant, Ernest, 2, Park-crescent, Torquay
1868		Quibell, Oliver, Shalem Lodge, Newark

Date of
Election.

1894		Quinn, Gerald Grattan, A.R.C.S., Rochdale Technical School, Rochdale
1913		Rae, William Norman, B.A. (Cantab.), Royal College, Colombo, Ceylon
1913		Rai, Kali Prosonuo, M.A. (Allahabad), Sanitary Commissioners' Laboratory, 2, Convent-lane, Calcutta, India
1912		Raith, William, Kutta P.O., Coorg, India
1912	Trans.	Rakshit, Jitendra Nath, 11/1, Bahir Mirjapur-road, Calcutta, India
1902		Ralphs, Edwin, Queen's College, Hong Kong
1892	Trans.	|| Ramage, Hugh, M.A. (Cantab.), A.R.C.S.I., F.I.C., Ridgemont, Carrow-hill, Norwich
1873	Trans.	†|| Ramsay, Sir William, K.C.B., Ph.D. (Tübingen, Cracow and Christiania), Hon. LL.D. (Birm., and Glas.), Hon. Sc.D. (Dub. and Cantab.), Hon. D.Sc. (Oxon., L'pool., Sheffield and Columbia), M.D. (Heidelberg and Jena), F.R.S., F.I.C., Commander of the Crown of Italy, Officier de la Legion d'Honneur, Ritter of the Order pour le Mérite, 19, Chester-terrace, Regent's Park, N.W.
1910		Ramsden, Frederick Valentine, The Royal Mint, Melbourne, Australia
1901		Ramsden, William Cecil, 107, Moyne-road, Rathmines, Dublin
1902		Ramshaw, Walter, Oakleigh, Cann-road, Shaftesbury, Dorset
1885		Ranken, Charles, Stockton-road, Sunderland
1889		Ransom, Francis, The Chilterns, Hitchin
1910		Ransome, Alfred Oswald, Beechwood, Greenock-road, Paisley
1911	Trans.	Raper, Henry Stanley, M.Sc. (Vict.), A.I.C., The University, Toronto, Canada
1898		Ratcliffe, Walter, 21, Mawdsley-street, Bolton
1905	Trans.	Ratcliffe, William Henry, B.Sc. (Lond.), 46, Glenhouse-road, Eltham Park, S.E.
1910		Rathey, Clifford Clare, c/o Electrical Power Storage Co., Ltd., West Ferry-road, Millwall, E.
1910		Rau, Malur Srinivasa, M.A., M.D. and B.Sc. (Edin.), D.P.H. (Cantab.), The Chemical Laboratory and Bacteriological Institute, Bangalore, Mysore, S. India
1906		Rawles, Walter Hansen, 193, King's Hall-road, Beckenham
1880	Trans.	|| Rawson, Christopher, F.I.C., 22, Cumberland-street, Manchester
1884		|| Rawson, Sidney George, D.Sc. (Lond.), F.I.C., Battersea Polytechnic, Battersea, S.W.
1908		Ray, Haradhan, M.A. (Calcutta), 9, Protap Chatterjee's-lane, College-street, Calcutta, India

† Longstaff Medallist, 1897.

Date of Election.		
1902	Trans.	Rây, Prafulla Chandra, Prof., C.I.E., D.Sc. (Edin.), Hon. D.Sc. (Dun.), Hon. Ph.D. (Calcutta), Presidency College, Calcutta
1911		Raymond, Percy James, 42, Infirmary-walk, Worcester
1912		Rayner, Edgar Alexander, B.Sc. (Lond.), 71, Welldon-crescent, Harrow
1889	Trans.	Read, Arthur Avery, Prof., M.Met. (Sheffield), F.I.C., University College, Newport-road, Cardiff
1895		Read, Edwin James, B.A. (Cantab.), F.I.C., Dart Villa, Victoria-avenue, Westgate-on-Sea
1899	Trans.	Read, Harold McLean, Waltham, Newlay Wood, near Leeds
1900		Readman, James Fraser, 24, Hamilton-drive, Glasgow, W.
1910		Reddie, John Alexander, Sewage Disposal Works, Halifax
1890		Redding, Richard James, 29, Isla-road, Plumstead, Kent
1906	Proc.	Redgrove, Herbert Stanley, B.Sc. (Lond.), 191, Camden-road, N.W.
1892		Redman, Henry Ramsden, Oaklands, Barnsole-road, Gillingham, Kent
1866	(C. 1891-2) (1910-)	Redwood, Sir Boverton, Bart., Hon. D.Sc. (Ohio), F.R.S.E., F.I.C., 4, Bishopsgate-street-within, E.C.
1889		Redwood, Robert, 4, Bishopsgate-street-within, E.C.
1886	Trans.	Rée, Alfred, Ph.D. (Berne), 15, Mauldeth-road, Withington, Manchester
1882	Proc.	Reed, Lester, F.I.C., Hyrsthof, 19, South-park-hill-road, South Croydon
1910	Trans.	Reed, Walter William, M.Sc. (Wales), F.I.C., Technical Institute, Norwich
1910		Rees, John James Beaumont, B.Sc. (Lond.), Johannesburg College, Johannesburg, S. Africa
1910		Rees, Thomas John, B.A. (Cantab.), B.Sc. (Wales), 211, Mears-street, Pretoria, S. Africa
1909		Regan, Colston James, B.Sc. (Lond.), 14, Penerley-road, Catford, S.E.
1880		Regester, William, 13, Corfton-road, Ealing, W.
1897		Reid, Alexander Ferguson, 58, George-street, Mile End, Glasgow
1893		Reid, Thomas Anderson, 51, Brockenhurst-gardens, Mill Hill, N.W.
1881		Reid, Walter Francis, F.I.C., Fieldside, Addlestone, Surrey
1911	Trans.	Reilly, Joseph, B.A. and B.Sc. (N.U.I.), A.R.C.S.I., 25, S. Circular-road, Portobello, Dublin
1910		Rele, Gangaram Rajendrarao, c/o Messrs. Morargee, Goculdass Mills, Ltd., Bombay, India
1912		Remers, Martin, L.R.C.P. and L.R.C.S. (Edin.), 24, Chorley Old-road, Bolton

Date of
Election.

1907	Trans.		Remfry, Frederic George Percy, B.A. (Cantab.), D.Sc. (Geneva), 14, Christchurch-road, Reading
1897			Remington, John Stewart, Aynsome, Grange-over-Sands, Carn- forth, Lanes.
1886			Remington, Joseph Price, Prof., 1832, Pine-street, Philadelphia, U.S.A.
1908			Rennie, Alexander, P.O. Box 703, Johannesburg, Transvaal, S. Africa
1879	Trans.		Rennie, Edward Henry, Prof., D.Sc. (Lond.), F.I.C., The University, Adelaide, S. Australia
1912			Rennie, John, Maisonnnette, Rufford-park, Yeadon, Leeds
1898	Proc.		Renwick, Frank Forster, Sunnyside, Weald-road, Brentwood, Essex
1909			Resker, Herbert Charles, B.A. (Cantab.), c/o Messrs. Butterfield & Swire, Hong Kong, China
1902	Trans.		Revis, Cecil, 5, Carlton-villas, Station-road, Barnes, S.W.
1873	Trans.	V.P. 1881-4, 89-92, 97-1900 P. 1901- 1903.	Reynolds, James Emerson, Prof., Hon. Sc.D. and Hon. M.D. (Dub.), M.R.C.P. (Ireland), L.R.C.P. and S. (Edin.), F.R.S., 3, Inverness-gardens, Kensington, W.
1898	Trans.		Reynolds, William Colebrook, B.Sc. (Lond.), Wharfdale, Engayne- gardens, Upminster, Romford
1908	Trans		Rhead, Ezra Lobb, M.Sc. Tech. (Manc.), F.I.C., Stonycroft, Polygon-avenue, Levenshulme, Manchester
1907			Rhodes, Percy Joseph, Bridge House, Church, Lanes.
1898	Trans.		Rich, Edward Milton, 211, King's Hall-road, Beckenham
1903			Rich, Stiles William George, c/o Messrs. Golding-Rich Co., Ltd., Cooroy, Queensland
1889			Richards, Duncan Taylor, 57, Osborne-avenue, Westoe-lane, South Shields
1889			|| Richards, Edgar, 60, Ayrault-street, Newport, Rhode Island, U.S.A.
1908			Richards, Francis Edward, B.Sc. (Lond.), A.R.C.S., County Secondary School, Redruth
1905			Richards, Frederick George, 43, Bowker-street, Higher Broughton, Manchester
1889			|| Richards, Percy Andrew Ellis, F.I.C., Thurn Lodge, Upper Richmond-road, Roehampton, S.W.; and Analytical Labor- atories, Royal Dental Hospital, Leicester-square, W.C.
1886			Richards, William, B.Sc. (Lond.), 58, Thrale-road, Streatham, S.W.
1888	Trans.		|| Richardson, Clifford, A.B. (Harvard), M. Am. Soc. C.E., 30, Church-street, New York City, U.S.A.

Date of
Election.

1906			||Richardson, Frederic Ion, B.A. (Cantab.), Wyuna, Murray-road, Northwood, Middlesex
1883			Richardson, Frederic William, F.I.C., County Analyst's Office Bradford
1888			Richardson, Hubert Naylor Bardsley, B.A. (Cantab.), 10, Friar-lane, Leicester
1911			Richardson, John Ffraid, Government Quinine Factory, Mangpu P.O., Sonada, D. H. Ry., India
1892			Richardson, Reginald Edensor Stanley, 10, Friar-lane, Leicester
1887	Trans.		Richmond, Henry Droop, F.I.C., 3, Coleraine House, Nassau-street, W.
1912			Rideal, Eric Keightley, B.A. (Cantab.), The Chalet, Elstead, Godalming, Surrey
1882	Trans.		||Rideal, Samuel, D.Sc. (Lond.), F.I.C., 28, Victoria-street, Westminster, S.W.
1910			Ridgway, Joseph, B.A. (Cantab.), Rownall Hall, Wetley Rocks, Stoke-on-Trent
1882	Trans.		||Ridsdale, Charles Henry, F.I.C., 3, Wilson-street, Middlesbrough
1911			Ridsdale, Noël Douglas, Ravenscroft, Roman-road, Linthorpe, Middlesbrough
1888			Rigby, John Samuel, 26, Bagot-street, Wavertree, Liverpool
1905			Rigby, Thomas, c/o The International Carbonizing Co., Ltd., Ironhurst Peat Factory, Ruthwell, Dumfriesshire
1898			Rigg, Gilbert, c/o The New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A.
1851	Trans.	C. 1878-80	Riley, Edward, F.I.C., 14A, Finsbury-square, E.C.
1904			Riley, Louis John Ezechiel, F.I.C., 8, Newton-road, W.
1900			Riley, Walter Alfred, 100, King-street, Norwich
1893			Rintoul, William, F.I.C., Lauriston, Ardrossan, Ayrshire
1909			Ritchings, Walter, M.Sc. (Manc.), The Cowley School, St. Helens
1911	Trans.		Rivett, Albert Cherbury David, B.A. (Oxon.), B.Sc. (Melbourne) The University, Melbourne, Australia
1907			Rixon, Frederic William, M.Sc. (Vict.), Ph.D. (Giessen), 93, Cromwell-road, Bristol
1908			Roach, William Frothingham, M.D. and M.S. (Montreal), M.D. <i>ad eundem</i> (McGill), D.P.H. (Oxon.), L.A.H. (Dub.), 7, Hill-street, Knightsbridge, S.W.
1902			Roast, Harold James, c/o Dr. J. T. Donald, 318, Lagauchetiere-street-west, Montreal, Canada
1893			Robbins, James Henry, B.Sc. (Lond.), 4, Selborne-road, Ilford, Essex
1912			Roberts, Alfred Reginald, c/o Canada Cement Co., Ltd., Shallow Lake, Ontario, Canada

Date of
Election.

1883		||Roberts, Frederick George Adair, Chemical Works, Carpenter's-road, Stratford, E.
1899		Roberts, James, jun., 605, Great Western-road, Hillhead, Glasgow
1876		Roberts, Martin Fenn, 137, Victoria-street, S.W.
1894		Roberts, Thomas John, Ingleside, Park-road, Huyton, near Liverpool
1912	Trans.	Roberts, Walter Morrell, M.Sc. (Manc.), A.I.C., Grange House, Claremont-road, Forest Gate, E.
1894		Robertson, Archibald Blair, 39, Westbury-road, Bristol
1903	Trans.	Robertson, Philip Wilfred, M.A., M.Sc., (N.Z.), M.A. (Oxon.), Ph.D. (Leipzig), 14, Great Ormond Street, W.C.
1907	Trans.	Robertson, Robert, M.A. and D.Sc. (St. Andrews), F.I.C., Research Department, Royal Arsenal, Woolwich, S.E.; and 29, Charlton-road, Blackheath, S.E.
1901	Trans.	Robertson, William, 21, Worfield-street, Battersea Park, S.W.
1889		Robins, Harry Hollis, c/o Messrs. Southwell and Co., Dockhead, S.E.
1903		Robinson, Archibald Louis, Surgeon, R.N., M.A. and M.B. (Dub.), Royal Naval Hospital, Malta
1913		Robinson, Arthur Samuel, B.Sc. (Manc.), King's School, Pontefract
1909	Trans.	Robinson, Frederic William, M.Sc. (L'pool.), c/o The Hanovia Chemical and Manufacturing Co., 233, N.J.R.R.-avenue, Newark, N.J., U.S.A.
1896		Robinson, Henry Fishwick, M.Sc. (Vict.), 334, Droylsden-road, Newton Heath, Manchester
1882	Trans.	||Robinson, Henry Haliburton, M.A. (Oxon.), F.I.C., 42, Pennywern-road, Earls Court, S.W.
1895		Robinson, Herbert Lewin, 1a, Middle Temple-lane, E.C.
1906		Robinson, Reginald Ernest, B.A. (Cantab.), The Villas, Stoke-on-Trent
1909	Trans.	Robinson, Robert, D.Sc. (Manc.), Chemical Department, The University, Sydney, N.S.W.
1911	Trans.	||Robison, Robert, Ph.D. (Leipzig), B.Sc. (Lond.), F.I.C., 78, Primrose-mansions, Battersea Park, S.W.
1904		Rodger, Robert, 4, Stevenage-road, Bishop's Park, Fulham, S.W.
1898		Rofe, Henry John, M.A. (Oxon.), 8, Victoria-street, Westminster, S.W.
1883		Rogers, Arthur William, Tadcaster Tower Brewery Co., Tadcaster
1905		Rogers, Harold Rudolf, M.A. (Oxon.), The Limes, Albert-street, Newcastle-under-Lyme, Staffs.
1909		Rogers, Herbert, 52, Cannon-street, E.C.
1903		Rogers, William David, B.Sc. (Lond.), A.R.C.S., F.I.C., 18, Gerald-street, Wrexham

Date of
Election.

1906	Trans.		Rogerson, Harold, M.Sc. (Manc.), Tavistock, Longlands-park-road, Sidcup, Kent
1894			Rolfe, John F., 71, Bristol-road, Edgbaston, Birmingham
1903			Roose, Fitzroy Owen Jonathan, Assoc.Inst.E.E., c/o The São Paulo Tramway Light and Power Co., Ltd., São Paulo, Brazil
1912			Roper, Herbert Carr, 42, Cavendish-place, Newcastle-on-Tyne
1855	Trans.	C. 1860-4, 1871-3 V.P. 73-5, 1877-80 P. 80-2	Roscoe, Sir Henry Enfield, P.C., B.A. (Lond.), D.C.L., (Oxon.), LL.D. (Cantab., Dub., Glas., Montreal, Aberd.), Ph.D. and Hon. M.D. (Heidelberg), Hon. D.Sc. (Vict.), F.R.S., 10, Bramham-gardens, S. Kensington, S.W.
1910			Rose, John George, Government Analytical Laboratory, Cape Town, S. Africa
1891	Trans.	C. 1897-8.	Rose, Thomas Kirke, D.Sc. (Lond.), 6, Royal Mint, E.
1896	Trans.		Rosenheim, Otto, Ph.D. (Würzburg), 75, Hampstead-way, Hendon, N.W.
1913			Roskin, Hermann Horace, B.Sc. (Wales), 11, Newlands-road, Middlesbrough
1894			Ross, Arthur, F.I.C., 1, Glengall-road, Old Kent-road, S.E.
1905			Ross, Frederick Wilson Montrose, 106, Wentworth-street S., Hamilton, Ontario, Canada
1896			Ross, Raymond St. George, F.I.C., Public Analyst's Office, Burnley
1902			Ross, William Charles, Capt., I.M.S., M.B., Ch.B. and D.P.H. (Edin.), 65, Cluny-gardens, Edinburgh
1891	Proc.		Rossiter, Edmund Charles, F.I.C., Brougham, West Hagley, Stourbridge
1892			Rothwell, Charles Frederick Seymour, Beech Croft, Mobberley, Knutsford
1904			Rouillard, Marie Jean Louis Ernest, B.Sc. (Edin.), Mount Moreland, Natal, S. Africa
1899			Royal-Dawson, Henry, Beechlands, Park-avenue, Ashton-on-Mersey, Sale, Manchester
1901			Royle, Charles Leonard, c/o The Cartavio Sugar Co., Hacienda Cartavio, Trujillo, Peru, S. America
1905			Royle, Harold Marmion, Store House, Gas Works, Beckton, North Woolwich
1909			Rudolf, Norman Scott, Prof., M.Sc. (Vict. and L'pool.), F.I.C., Indian Institute of Science, Bangalore, India
1872	Trans.		Ruffle, John, F.I.C., Mnsley, Ware, Herts.
1895			Rugginz, William Augustus, St. Leonards, Glebe-avenue, Woodford Green, N.E.
1889	Trans.	C. 1903-05	Ruhemann, Siegfried, M.A. (Cantab.), Ph.D. (Berlin), 3, Selwyn-gardens, Cambridge

Date of Election.		
1883		Rumble, Charles, F.I.C., 169, Gleneldon-road, Streatham, S.W.
1908		Runeckles, Arthur Robert, B.Sc. (Lond.), A.C.G.I., c/o Messrs. Brotherton & Co., Litherland Tar Works, Litherland, Liverpool
1913		Rusby, Reginald William, 12, Blenheim-road, Redland, Bristol
1890		|| Russell, Edward, B.Sc. (Lond.), F.I.C., 28, Apsley-road, Clifton, Bristol
1898	Trans.	C. 1912- Russell, Edward John, D.Sc. (Lond.), Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1901		Russell, James Bertram, B.Sc. (Lond.), Marston, Belsize-road, Worthing
1910		Russell, John, B.A. (Oxon.), 4, Kenbourne-grove, Sheffield
1908		Rutter, Clement Thomas, Llechfaen, Brecon.
1896		Rutter, Thomas Francis, B.Sc. (Lond.), Ph.D. (Leipzig), New-castle-under-Lyme
1894		Ryce, George, B.A. (R.U.I.), Irish Agricultural Offices of the Potash Syndicate, 50, Essex-street, Dublin
1901	Trans.	Ryffel, John Henry, M.A. (Cantab.), B.Sc. (Lond.), F.I.C., 10, Grasmere-road, Muswell Hill, N.
1888		|| Sach, Albert John, Silverdale, Bowning, N.S.W.
1896		Sage, Charles Edward, F.I.C., 10, London-street, Fenchurch-street, E.C.
1909	Trans.	Sageman, Philip John, Government Laboratory, Clements Impassage, Strand, W.C.
1907		Sahni, Ruchi Ram, M.A. (Punjab), Government College, Lahore, India
1879	Trans.	|| Sakurai, Joji, Prof., Science College, Imperial University, Tokio, Japan, via Siberia
1880		Salamon, Alfred Gordon, A.R.S.M., F.I.C., 1, Fenchurch-avenue, E.C.
1908		Salamon, Maurice Salamon, 79, Mark-lane, E.C.
1906		Salmon, Frederick John, c/o Government Survey Department, Colombo, Ceylon
1876		|| Salomons, Sir David Lionel, Bart., M.A. (Cantab.), Assoc. Inst.C.E., J.P., D.L., Broomhill, Tunbridge Wells; and 49, Grosvenor-street, W.
1871		|| Salter, Mortyn John, F.I.C., Bank House, Mickleton, Campden, Glos.
1859		|| Salter, Thomas William, 193, Priory-road, West-hill, Hastings
1907	Trans.	Salway, Arthur Henry, D.Sc. (Lond.), Ph.D. (Leipzig), 7, Kildowan-road, Goodmayes, Ilford, Essex

Date of
Election.

1902		Sampson, John William, The Cleveland Pharmacy, Bath.
1882		Samuel, William Cobden, Elmdale, 66, Croxted-road, West Dulwich, S.E.
1909		San U, Maung, Chemical Examiner's Office, Rangoon, Burma
1898	Trans.	||Sand, Henry Julius Salomon, Ph.D. (Zürich), D.Sc. (Birm.), University College, Nottingham
1870		||Sandberg, Christer Peter, Palace-chambers, 9, Bridge-street, Westminster, S.W.
1900	Trans.	Sanders, James McConnell, c/o Direccion General de Aduanas, Mexico City
1904		Sanders, Percy Richard, West Cliffe, Seaford, Sussex
1888		Sanderson, John, F.I.C., c/o Messrs. B. S. Cohen, Ltd., Britannia Pencil Works, Neasden-lane, N.W.
1890		Saniter, Ernest Henry, Strafford Villa, Moorgate, Rotherham
1891		Sanyal, Abhayacharan, M.A. (Calcutta), Sonarpura, Benares, U.P., India
1892		Sarbadhicary, Satya-prasad, 1, College-street, Calcutta, India
1900		Sargeant, Fred Pilkington, College of Pharmacy, Clarendon-road, Leeds
1912		Sasson, Albert, M.R.A.C., Dept. of Agriculture, Cairo, Egypt
1913		Sastry, Sosale Garalapury, B.A. (Madras), Indian Institute of Science, Hebbal, Bangalore, India
1907		Saunders, George Joseph, B.E. (Sydney), Central Technical College, Brisbane, Queensland, Australia
1913		Saunders, William Gilbert, A.I.C., 34, Hanover-street, Liverpool
1908		Saunderson, William, B.Sc. (Dun.), Cooverull Academy, Bowenfels, N.S.W.
1911		Saville, William Bristow, 5, Howard-street, Horton-lane, Bradford
1909		||Sawbridge, Bartle Frere, M.A. (Oxon.), F.I.C., 90, Guilford-street, Russell-square, W.C.
1898		Sayer, Harold Charles, 3, King Edward-avenue, Dartford
1890		Sayers, William Charles, 63, High-street, Lewisham, S.E.
1885		||Scammell, Luther Robert, c/o Messrs. F. H. Faulding & Co., 54, King William-street, Adelaide, S. Australia
1912	Trans.	Scarborough, Harold Archibald, B.Sc. (Birm.), 60, Highbury-terrace, Hill-street, Coventry
1877		Scarf, Isaac Sydney, F.I.C., City of London School, Victoria Embankment, E.C.; City of London College, White-street, Moorfields, E.C.; and 88, Palmerston-crescent, Palmer's Green, N.
1897		Scargill, Lionel Walter Kennedy, M.A. (Oxon. and Cantab.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), St. George's Hospital, Hyde Park-corner, S.W.
1893	Trans.	Schidrowitz, Philip, Ph.D. (Berne), 57, Chancery-lane, W.C.

Date of Election.		
1888		||Schieffelin, William Jay, Ph.B. (Columbia), 170, William-street, New York City, U.S.A.
1907		Schlienger, Charles, B.Sc. (Lond.), Acadia House, 273, Camden-road, N.
1907		Schober, William Bush, A.M. and B.Sc. (Annapolis), Ph.D. (Johns Hopkins), Lehigh University, South Bethlehem, Pa., U.S.A.
1892		||Schofield, James Alexander, A.R.S.M., F.I.C., The University, Sydney, N.S.W.
1902		Scholes, William, Mount Sion, Radcliffe, Lancs.
1911		Scopes, Lionel Gowing, 14, Carson-road, Dulwich, S.E.
1899	Trans.	Schryver, Samuel Barnett, D.Sc. (Lond.), Ph.D. (Leipzig), Imperial College of Science and Technology, S. Kensington, S.W.
1909		Schulten, Joseph Henry Charles, Ph.D. (Erlangen), P.O. Box 279, 4, Pollock-street, Calcutta, India
1879	Trans.	{C. 1897-9 S. 1899- 1904 T. 1904-} ||Scott, Alexander, M.A. and Sc.D. (Cantab.), M.A. (Dun.), D.Sc. (Edin.), F.R.S., F.I.C., 34, Upper Hamilton-terrace, St. John's Wood, N.W.
1908		Scott, Andrew Laidlaw, F.I.C., Royal Gunpowder Factory, Waltham Abbey, Essex
1890		Scott, Ernest George, Kingsway House, Kingsway, W.C.
1901		Scott, George Charlton, c/o Messrs. Burn & Co., Ltd., Ranee-gunge, Bengal, India
1905		Scott, John Irwin, M.A. (Oxon.), Langford House, London-road, Kettering
1906		Scouller, Walter Daly, B.Sc. (Vict.), Chester Corporation Sewage Purification Works, Chester
1883	Proc.	Seudder, Frank, F.I.C., 44, Mosley-street, Manchester
1906		Seaber, Willie Macro, B.Sc. (Lond.), F.I.C., 26, Cambridge-road, Cottenham-park, Wimbledon, S.W.
1896		Seabrooke, Herbert Cecil, F.I.C., Black Ash, Grays, Essex
1912		Seal, Kunjo Behary, 5, Nilmony Dutt-lane, Calcutta, India
1891		Searl, Albert, Montreux, Victoria-road, Sidcup, Kent
1905		Seaton, William Dunham, 40, Argyle-road, Ilford, Essex
1908		Seelhorst, William, c/o Eastern Smelting Co., Ltd., Seremban, Negri Sembilan, Federated Malay States
1909	Trans.	Segaller, David, B.Sc. (Lond.), A.R.C.S., 2, Cannon Hill-terrace, Kingston-road, Merton Park, S.W.
1898		Seligman, Richard, Ph.D. (Heidelberg), A.C.G.I., Oakwood, Oxshott-road, Leatherhead
1892	Trans.	C. 1905-09 Sell, William James, M.A. and Sc.D., (Cantab.), F.R.S., F.I.C., University Chemical Laboratory, Pembroke-street, Cambridge
1875		Sellon, John Scudamore, 78, Hatton-garden, E.C.

Date of
Election.

1910		Sen, Aswini Kumar, B.A. (Calcutta), B.Sc. (Vict.), The Bengal Luxmi Mills, Serampore, near Calcutta, India
1904	Trans.	Sen, Jatindra Nâth, M.A. (Calcutta), Agricultural Research Institute, Pusa, Bengal, India
1910	Trans.	Sen, Rajendra Nath, Prof., M.A. (Calcutta), M.Sc. (Leeds), Engineering College, Sibpur, Calcutta, India
1875	Trans.	||Senier, Alfred, Prof., Hon. D.Sc. (R.U.I.), M.D. (Mich.), Ph.D. (Berlin), F.I.C., 28, Herbert-park, Donnybrook, Dublin
1906		Senior, John, c/o Messrs. Morgan, Crossley & Co., Ltd., Ducie Mills, Miles Platting, Manchester
1903	Trans.	Senter, George, D.Sc. (Lond.), Ph.D. (Leipzig), Chemical Laboratory, St. Mary's Hospital Medical School, Paddington, W.
1896		Severn, Walter Dalrymple, A.R.C.S., Public Health Laboratory, Cape Town, S. Africa
1907		Sewell, William George, B.Sc. (Lond.), Bournemouth School, Bournemouth
1874		||Sexton, Alexander Humboldt, Prof., F.I.C., F.R.S.E., c/o The Librarian, The Technical College, 204, George-street, Glasgow
1895	Trans.	Seyler, Clarence Arthur, B.Sc. (Lond.), F.I.C., The Technical Institute, Nelson-terrace, Swansea
1904		Shacklady, Thomas George, Hope House, Cliffe-at-Hoo, Rochester
1880		Shadwell, John Emilius Lancelot, F.I.C., Osborne House, Bathwick-terrace, Bath
1874		Sharman, William, 186, Marc-street, Hackney, N.E.
1910		Sharpe, Frederic Herbert, 25, Norman-road, Runcorn
1895		Sharrott, Thomas Chilwell, B.A. (Dub.), A.R.C.S., F.I.C., 3, Mornington-road, Chingford, N.E.
1895	Trans.	||Shaw, George Elliott, B.Sc. (Lond.), F.I.C., Mungpoo P.O. Sonada, D.H. Railway, Bengal, India
1908	Trans.	Shaw, William Bayliss, M.A. and B.Sc. (Oxon.), Lonsdale House Walsall
1912		Shaw, William Daveridge Hamilton, B.Sc. (Wales), c/o The Coppee Coke Oven Co., Ltd., King's House, Kingsway, W.C.
1887		Sheard, John Tomlinson, Birley Carr, Sheffield
1899		Shelbourn, Edward Thomas, F.I.C., 40, Craven-street, Strand, W.C.
1897		Shenton, James Porter, 37, Torbay-road, Chorlton-cum-Hardy near Manchester
1907	Trans.	Shepherd, Frederick George, B.Sc. (Lond.), A.R.C.S., F.I.C. Clarencefield, Ruthwell, Dumfriesshire
1899	Trans.	Shepherd, William Frederick John, 12, Bridge-street-row, Chester
1906		Shepherd, Arthur Burton, B.Sc. (Vict.), F.I.C., c/o The British Oil and Cake Mills, Ltd., Copenhagen Mill, Limehouse, E.

Date of Election.		
1874		||Shepherd, Harcourt Henry Benjamin, F.I.C., Crayside, Bexley, Kent
1899		Shepherd, John William, B.Sc. (Lond.), 3, Fairlawn-road, Wimbledon, S.W.
1901	Trans.	Sheppard, Samuel Edward, D.Sc. (Lond.), 35, Warkworth-street, Cambridge
1901		Shepperson, William, Deerswood, Crawley
1891	Trans.	||Shields, John, D.Sc. (Edin.), Ph.D. (Strassburg), F.I.C., 4, Stanley-gardens, Cricklewood, N.W.
1908		Shilstone, Herbert Maxwell, B.Sc. (Tulane), Room 301, Wells Fargo Building, New Orleans, U.S.A.
1896		Shimomura, Kotaro, Prof., Shinkarasumara, Kajinguchi Sagaru, Kyoto, Japan
1894		Shorthouse, Herbert Stephen, 144, Edmund-street, Birmingham
1913		Shrewsbury, Herbert Sutcliffe, F.I.C., Government Laboratory, Trinidad, British West Indies
1906		Shrimpton, John Kirby, Redshaw House, Ripon
1904		Shrubsole, Alfred, 16, The Grove, Golders Green, N.W.
1912		Shute, Henry Alfred, B.Sc. (Lond.), The Grammar School, Kendal
1886		Shutt, Frank Thomas, M.A. (Toronto), F.I.C., Experimental Farm, Ottawa, Canada
1890		Shuttlewood, Willis Brewin, 78, Whitehall-park, Hornsey-lane, Highgate, N.
1894		Shuttleworth, Edward Buckingham, Prof., 220, Sherborne-street, Toronto, Canada
1904		Siau, Raymond Louis, 15, Merridale-lane, Wolverhampton
1903		Sibley, Samuel Edward, c/o Messrs. Mauri Bros. and Thomson, Ltd., Castlereagh-street, Sydney, N.S.W.
1889		Sibson, Alfred Edward, 92, Lansdowne-place, Hove, B.O., Brighton
1903		Siddle, George, Middleton-one-row, Co. Durham
1902	Trans.	||Sidgwick, Nevil Vincent, M.A. (Oxon.), Sc.D. (Tübingen), Lincoln College, Oxford
1900	Trans.	Silberrad, Oswald, Ph.D. (Würzburg), Buckhurst Hill, Essex
1886		Silvester, Harry, B.Sc. (Birm.), F.I.C., 78, Holy Head-road, Handsworth, Birmingham
1899	Trans.	Simmonds, Charles, B.Sc. (Lond.), Airdrie, 61, Cottenham-park-road, Cottenham-park, Wimbledon, S.W.
1889		Simmonds, Henry, Engineer's Office, Gas Works, and Elton View House, Bury, Lanes.
1887		||Simmons, Leonard Owen, 15, Leigham Court-road, Streatham Hill, S.W.
1905		Simmons, William Herbert, B.Sc. (Lond.), Oakleigh, Stoke Newington Common, N.

Date of
Election.

1895		Simons, Albert Joseph, c/o M. Simons, Esq., 31, Little Britain, E.C.
1906	Trans.	Simonsen, John Lionel, Prof., D.Sc. (Manc.), Presidency College, Madras, India
1896		Simpson, Aitken Megget, 107, Great Victoria-street, Belfast
1902		Simpson, Duncan Ivan Rennard, c/o Willoughby's Consolidated Co., Ltd., P.O. Box 220, Bulawayo, S. Africa
1897		Simpson, Edward Sydney, B.E. (Sydney), Geological Survey Laboratory, Museum-street, Perth, Western Australia
1886	Proc.	||Simpson, William Selby, F.I.C., The Gables, Cannon-hill, Southgate, N.
1913	Proc.	Simpson, William Slessor, M.A. and B.Sc. (Aberd.), Durban Roodeport Deep G. M. Co., Ltd., P.O. Box 110, Roodeport, Transvaal, S. Africa
1910		Sinclair, St. Clair Overbeek, M.A. (Cape of Good Hope), Government Analytical Laboratory, Parliament-street, Cape Town, S. Africa
1889		Singer, Ignatius, 3, Parkfield-road, Manningham, Bradford
1912	Trans.	Singh, Bawa Kartar, Prof., M.A. (Cantab.), Dacca College, Dacca, Bengal, India
1908		Singh, Puran, Acting Imperial Forest Chemist, Dehra Dun, U.P., India
1909		Sinha, Manindra, B.A. (Allahabad), St. Xavier's College, 10 and 11, Park-street, Calcutta, India
1902	Proc.	Sinnatt, Frank Sturdy, 321, Great Clowes-street, Higher Broughton, Manchester
1896		||Sircar, Amrita Lal, 51, Sankaritola, Calcutta, India
1912	Proc.	Sircar, Anakul Chandra, M.A. (Calcutta), Dacca College, Dacca, Eastern Bengal, India
1902		Skertchly, William Pearson, F.I.C., 11, Billiter-square, E.C.
1888	Trans.	Skinner, Sidney, M.A. (Cantab.), South Western Polytechnic, Manresa-road, Chelsea, S.W.
1892		Skurray, Thomas, United Breweries, Abingdon, Berks.
1912		Sladden, Cyril Edgar, 12, Charleville-circus, Sydenham, S.E.
1910	Trans.	Slade, Roland Edgar, M.Sc. (Vict.), Muspratt Laboratory, The University, Liverpool
1879		Slater, Charles, M.A. and M.B. (Cantab.), M.R.C.S. (Eng.), 81 St. Ermin's-mansions, Westminster, S.W.
1880	Trans.	||Slater, Harold Humboldt, F.I.C., Club de Residentes Extranjeros Buenos Ayres, Argentine, S. America
1903	Trans.	Slator, Arthur, Ph.D. (Leipzig), D.Sc. (Birm. and Lond.), F.I.C. 174, Ashby-road, Burton-on-Trent
1878		||Slatter, George William, A.R.C.S.I., F.I.C., 241, Carlton-terrace Nab Wood, Shipley, Yorks.

Date of Election.		
1895		Slocum, Frank Leroy, Ph.D. (Strassburg), 401, South Linden-avenue, E.E., Pittsburg, Pa., U.S.A.
1912	Trans.	Smart, Bertram James, B.Sc. (Lond.), Government Testing Office, Lithgow, N.S.W.
1875		||Smetham, Alfred, F.I.C., 16, Brunswick-street, Liverpool
1898	Trans.	S. 1912- Smiles, Samuel, D.Sc. (Lond.), University College, Gower-street, W.C. ; and The Quarry, Sanderstead-road, S. Croydon
1883		Smith, Adolphe, 12, Crookham-road, Fulham, S.W.
1890	Trans.	||Smith, Alexander, Prof., Ph.D. (Munich), B.Sc. (Edin.), Department of Chemistry, Columbia University, New York City, U.S.A.
1888		Smith, Angus, F.I.C., 7, Eldon-street, Greenock.
1911		Smith, Bernard Charles, 97, Bethune-road, Stamford Hill, N.
1906		Smith, Charles, Knowsley-road, Smithills, Bolton
1904	Trans.	Smith, Clarence, D.Sc. (Lond.), 28, Chadwick-road, Leyton-stone, N.E.
1894	Trans.	Smith, Claude, F.I.C., Barngarth, Cartmel, Carnforth
1884		||Smith, Edgar Francis, Trelawny, 21, Fairfax-road, Bedford Park, W.
1910		Smith, Ernest William, B.A. and B.Sc. (Lond.), A.I.C., 20, St. Bevan's-road, Halifax
1906		Smith, Frank, B.Sc. (Vict.), 102, Chorley New-road, Bolton
1874		Smith, George, F.I.C., Nobel's Explosives Co., Polmont Station
1896		Smith, George Egerton Scott-, F.I.C., 67, Surrey-street, Sheffield
1892		||Smith, George Percy Darnell-, B.Sc. (Lond.), F.I.C., Biological Branch, Agricultural Museum, 138, George-street-north, Sydney, N.S.W.
1912	Trans.	Smith, Henry Edgar, M.Sc. (Birm.), Government Laboratory, Clement's Inn-passag, Strand, W.C.
1896	Trans.	Smith, Henry George, The Technological Museum, Sydney, N.S.W.
1904		Smith, Henry Heron, F.I.C., Tower House, Belvedere, Kent
1909	Trans.	Smith, Henry Llewellyn, B.Sc. (Manc.), F.I.C., King's College for Women, Kensington-square, W.
1878		Smith, Henry Russell, F.I.C., 1, Aubert-park, Highbury, N.
1900		||Smith, Herbert Procter, Highfield, Shotton, Flints.
1901		Smith, James, Sunnyside, Groes-road, Cressington, Liverpool
1903		Smith, James Cruickshank, B.Sc. (Aberd.), King's House, King-street, E.C.
1910		Smith, James Harry, 9, High-street, Rishton, Blackburn
1911	Trans.	Smith, John Henry, Talleres F.C.C.A., Oficina de Locomotoras, Rosario-de-Santa Fé, Argentine, S. America
1913		Smith, John Walter, B.Sc. (Lond.), 48A, Hurstbourne-road, Forest Hill, S.E.
1879		||Smith, John William, 7, Brookfield-street, Roslindale, Boston Mass., U.S.A.

Date of
Election.

1913			Smith, Montagu George, 8, Cross-road, Bromley Common, Bromley, Kent
1901	Trans.		Smith, Norman, D.Sc. (Vict.), The University, Manchester
1910			Smith, Percy Lancelot James, M.A. (Oxon.), A.I.C., Kelly College, Tavistock
1912			Smith, Richard Coupe, 150, Stephens-street, Belleville, New Jersey, U.S.A.
1902			Smith, Robert Ely Blake, B.Sc. (Lond.), A.I.C., 31, St. John's road, Putney, S.W.
1897			Smith, Robert Francis Wood, 90, Lower Thames-street, E.C.
1891			Smith, Robert Greig, D.Sc. (Edin.), M.Sc. (Dun.), Linnean Society's House, Elizabeth Bay, Sydney, N.S.W.
1907			Smith, Robert Harry, Apsley House, Priory-road, Sheffield
1907			Smith, Robert Low, c/o Messrs. Vickers, Sons and Maxim, Ltd., Erith, Kent
1888			Smith, Samuel, 132, High-street, Tonbridge
1907			||Smith, Sydney William, B.Sc. (Lond.), A.R.S.M., The Royal Mint, E.
1912	Trans.		Smith, Thomas Alfred, B.Sc. (Lond.), A.I.C., University College, Nottingham
1910			Smith, Thomas May, c/o Messrs. A. Boake, Roberts & Co., Ltd., Carpenter's-road, Stratford, E.
1866	Trans.		Smith, Watson, F.I.C., 34, Upper-park-road, Haverstock Hill, N.W.
1876			||Smith, William Alexander, M.A. and M.B. (Oxon.), M.R.C.S. (Eng.), 70, Pembroke-road, Clifton, Bristol
1912			Smith, William Charles, Church-lane, Lowton, Newton-le-Willows
1910			Smith, William James Pittock, c/o Messrs. R. Hornsby & Son, Barrack-street, Sydney, N.S.W.
1903			Smith, William Veysey, B.A. (Oxon.), 56, Prince's-square, W.
1883	Trans.	{ C. 1896- 1900. V.P. 1905-08 }	||Smithells, Arthur, Prof., B.Sc. (Lond.), F.R.S., F.I.C., The University, Leeds
1873			||Smyth, John, M.A. (Dub.), M.Inst.C.E., Milltown, Banbridge, Ireland
1908	Trans.		Smythe, John Armstrong, D.Sc. (Dun.), Ph.D. (Göttingen), Armstrong College, Newcastle-on-Tyne
1902			Smythe, John Seabury, M.Sc. (Vict.), Ph.D. (Würzburg), 22, Rawlinson-road, Hesketh-park, Southport
1887	Trans.		||Snape, Henry Lloyd, Prof., D.Sc. (Lond.), Ph.D. (Göttingen), F.I.C., Balholm, Lathom-road, Southport
1899	Trans.		Soddy, Frederick, M.A. (Oxon.), F.R.S., Chemical Department, The University, Glasgow
1887			Sohn, Charles Emile, F.I.C., 52, Fore-street, E.C.

Date of Election		
1891		Solomon, Frank Oakley, Dauntsey's Agricultural School, West Lavington, Devizes, Wilts.
1898		||Somerville, Henry, B.Sc. (Lond.), Harrold, Sharnbrook, Beds.
1906		Somerville, David, B.A. (R.U.I.), M.D., B.Ch., and D.P.H. (Cantab.), M.R.C.P. (Lond.), 31, Manor House, Marylebone-road, N. W.
1910		Sorabji, Kaikhushroo Bamanji, L.M. and S. (Bombay), Secunderabad, Deccan, India
1893		Sorrell, Henry Thomas, B.Sc. (Lond.), 54, Newcombe-road, Polygon, Southampton
1875		Southall, Alfred, Garrick House, Richmond Hill, Edgbaston
1897	Proc.	||Southerden, Frank, B.Sc. (Lond.), F.I.C., Royal Albert Memorial College, Exeter
1910	Trans.	Southgate, Herbert William, B.Sc. (Lond.), Tattingstone, Ipswich
1883		Soward, Alfred Walter, C.B., 28, Therapia-road, Honor Oak, S.E.
1892		Spackman, Charles, Rosehaugh, Clitheroe, Lancs.
1908		Speed, John Day, 206, Hertford-road, Waltham Cross
1905		Speight, William Ewart, Corporation Sewage Works, Bolton
1883		||Spencer, Ernest Samuel, 181, Drummond-road, Southwark Park, S.E.
1906	Trans.	Spencer, James Frederick, D.Sc. (L'pool.), B.Sc. (Vict.), Ph.D (Breslau), Bedford College for Women, Baker-street, W.
1886		Spencer, Richard, 242, Dalton-road, Barrow-in-Furness
1894		Spenser, John George, Prof., M.D. (Ohio), Ph.D. (Strassburg) Ohio Wesleyan University, 1825, East 93rd street, N.E., Cleveland, Ohio, U.S.A.
1904		Spielmann, Percy Edwin, B.Sc. (Lond.), Ph.D. (Bâle), A.R.C.S., F.I.C., 21, Cadogan-gardens, S.W.
1908		Spiers, Charles Sedgley, Beaudesert, Queensland, Australia
1859	Trans.	||Spiller, John, F.I.C., 2, St. Mary's-road, Canonbury, N.
1863		||Spiller, William, F.I.C., 2, Lindfield-gardens, Hampstead, N.W.
1885		||Spottiswoode, William Hugh, Balliol College, Oxford; and 6, Middle New-street, E.C.
1906	Trans.	Sproxtton, Foster, B.Sc. (Lond.), Biantam Works, near Manningtree, Essex
1882		||Squire, Peter Wyatt, 413, Oxford-street, W.
1892		Squires, Alfred James, Greenbank, Coroner's-lane, Farnworth, Widnes, Lancs.
1899		Stainer, John Ward, 103, Cheriton-road, Folkestone
1879	Trans.	||Stallard, George, M.A. (Oxon.), Pra Oursi, Champ de Praz, Val d'Aosta, Italy
1911		Stanford, Robert Viner, Ph.D. (Kiel), M.Sc. (Birm.), B.Sc. (Lond.), Cardiff City Mental Hospital, Whitechurch, Cardiff

Date of Election.		
1904		Stanger, Reginald Harry Hursthouse, Chemical Laboratory and Testing Works, 2, Broadway, Westminster, S.W.
1902		Stanger, William Charles South, Ambleside, Corder-road, Ipswich
1887		||Stansell, Lionel William, F.I.C., 7, Albion-place, Maidstone, Kent
1895		||Stansfield, Alfred, D.Sc. (Lond.), McGill University, Montreal, Canada
1902		Stansfield, Edgar, M.Sc. (Vict.), McLaren Apartments, McLaren-street, Ottawa, Canada
1913		Stansfield, William James, A.R.C.S., 12, Bell Hall-terrace, Savile-park, Halifax
1900	Trans.	Stapleton, Henry Ernest, Prof., M.A. and B.Sc. (Oxon.), The Club, Dacca, Eastern Bengal and Assam, India
1870		Starey, Arthur John, 39, Woodland-gardens, Highgate, N.
1870	Trans.	||Stark, James Fleming, Rosedale, Bromborough, Cheshire
1908		Stead, Arthur, B.Sc. (Vict.), Government Laboratories, Bloemfontein, Orange River Colony, S. Africa
1902		Stead, Francis Bernard, 1, Thornton-hill, Wimbledon, S.W.
1896		Stead, John Christopher, 55, Chancery-lane, W.C.
1882	Trans.	Stead, John Edward, D. Metall. (Sheffield), F.R.S., F.I.C., 11, Queen's-terrace, Middlesbrough
1910		Stedman, Ernest, M.Sc. (Vict.), The Orms, Spring Bank, Wigan
1897		Steel, Frederick William, c/o General Chemical Co., Ltd., Clyde, Sydney, N.S.W.
1885		||Steel, Robert Elliot, Avoca, Newland, Sherborne
1900	Trans.	Steele, Bertram Dillon, Prof., D.Sc. (Melbourne), The University, Brisbane, Queensland, Australia
1912	Trans.	Steele, Victor, 55, Amersham-road, New Cross, S.E.
1905		Steger, James, B.Sc. (Lond.), 10, Elmdale-road, Clifton, Bristol
1898		Steinhart, Oscar Julian, Ph.D. (Erlangen), 65, London-wall, E.C.
1901		Stell, Samuel Fenton, 25, Henry-street, Keighley
1892	Trans.	||Stenhouse, James, Kenmore, Lasswade, Midlothian
1884		Stenhouse, Thomas, F.I.C., 166, Drake-street, Rochdale
1912		Stephen, Alfred Ernest, c/o The Chilean Nitrate of Soda Propaganda, 129, Pitt-street, Sydney, N.S.W.
1895	Trans.	Stephens, Frank Robert, c/o Messrs. Idris, Pratt-street, Camden Town, N.W.
1880		||Stephens, Henry Charles, Avenue House, Finchley, N.
1897		Stephens, Michael Edmund, 57, Aldersgate-street, E.C.
1910		Stephenson, Guy, Alexandra-terrace, Crook, Co. Durham
1895		Stephenson, Herbert Frederick, A.R.C.S., F.I.C., 8, Mitcham-park, Mitcham, Surrey
1901		Stephenson, Robert, jun., M.A. (Cantab.), Burwell, Cambridge
1891	Trans.	||Stephenson, Thomas, F.R.S.E., 137, George-street, Edinburgh

Date of Election.		
1888	Trans.	Stern, Arthur Landauer, D.Sc. (Lond.), F.I.C., 148, High-street, Burton-on-Trent
1896		Stewart, Douglas Stuart Spens, B.Sc. (Vict.), Bollowall, St. Just, Cornwall
1905		Stevens, Harold Blythen, A.I.C., Oxford Works, Tower Bridge-road, S.E.
1897	Trans.	Stevens, Henry Potter, M.A. (Oxon.), Ph.D. (Heidelberg), F.I.C., 15, Borough, London Bridge, S.E.
1903		Stevens, Montague White, A.R.C.S., F.I.C., H.M. Patent Office, 25, Southampton-buildings, W.C.
1899		Stevenson, Arnold, B.A. (Cantab.), 4, Porchester-gardens, W.
1903	Trans.	Stevenson, Henry Edward, Entwistle, Empress-avenue, Woodford Green, N.E.
1904		Stevenson, Henry Ernest, Avondale, Ditton Hill, Surrey
1909		Stevenson, James Thomas, 67, Surrey-street, Sheffield
1879		Stevenson, William, 95A, Southwark-street, S.E.
1908		Stewart, Alexander Mackintosh, 31, Moss Bank, Richmond-street, Ashton-under-Lyne
1903	Trans.	Stewart, Alfred Walter, D.Sc. (Glas.), 7, Upper-crescent, Belfast
1902		Stewart, Hector, Solai, Wagin, Western Australia
1907		Stobie, Harold Ramsay, 18-20, Broad-street House, New Broad-street, E.C.
1866		Stock, William Frederick Keating, F.I.C., County Analyst's Office, Darlington
1887		Stocks, Herbert Birtwhistle, F.I.C., 12, Victoria-road, West Kirby, Cheshire
1894	Trans.	Stoddart, Frederick Wallis, F.I.C., Grafton Lodge, Sneyd-park, Bristol
1879	Proc.	||Stokes, Alfred Walter, F.I.C., 179, Edgware-road, W.
1911		Stokes, George Alfred, 179, Edgware-road, W.
1873		||Stone, Edward Daniel, Ackersley, Cheadle Hulme, near Stockport, Cheshire
1895		Stone, George, Esk Brewery, Launceston, Tasmania
1875		||Stone, John Frederic Matthias Harris, M.A. (Cantab.), Barrister-at-Law of the Western Circuit, 42, Bloomsbury-square, W.C.; and Oxford and Cambridge Club, 17, Pall Mall, S.W.
1879		||Stone, William, M.A. (Cantab.), Oxford and Cambridge, Garrick, Bath, Union, Royal Societies, Automobile, and Reform Clubs; and 63, Curzon-street, Mayfair, W.
1909		Stones, George Bertram, M.Sc. (Manc.), Bank-villas, Tyldesley, Manchester
1906		Storey, Francis Wylie, B.Sc. (Lond.), Normal Training College, Bloemfontein, Orange Free State, S. Africa

Date of
Election.

1900		Storr, Bertram Vincent, M.Sc. (Vict.), 26, The Square, Garden Suburb, Ilford
1909		Strachan, James Thallon, 10, Nelson-street, Sunderland
1904	Trans.	Streatfeild, Frederick Henry, 54, Belgrave-road, Wanstead, N.E.
1906		Streimer, Emanuel George, 4, Clova-road, Forest Gate, E.
1912		Strivens, Percy Rudolph, Ash Villa, St. Andrew's-road South, St. Anne's-on-the-Sea, Lancs.
1909		Strohmenger, Arthur Percy, Caxton House, Westminster, S.W.
1900		Strong, Archie Hugh, 63, Herne-hill-road, Camberwell, S.E.
1904	Trans.	||Struthers, Robert de Jersey Fleming, M.A. and B.Sc. (Oxon.), 32, Leyland-road, Lee, S.E.
1885	Trans.	||Stuart, Charles Maddock, M.A. (Cantab.), F.I.C., St. Dunstan's College, Catford, S.E.
1910		Stuart, Murray, Prof., D.Sc. (Birm.), Presidency College, Madras, India
1897	Trans.	Stubbs, George, F.I.C., Beresford House, Beresford-road, East Finchley, N.
1907		Sturrock, George Colleymore, Capt. R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India
1890	Trans.	||Sudborough, John Joseph, Prof., D.Sc. (Lond.), Ph.D. (Heidelberg), F.I.C., Indian Institute of Science, Bangalore, India
1878	Trans.	||Sugnira, Shigetake, c/o Tokyo Chemical Society, Science College, Imperial University, Tokyo, Japan
1911		Summers, George Douglas, Beechholme, Tolworth-road, Ipswich
1887		||Sutherland, David Alexander, F.I.C., 26, Victoria-street, Westminster, S.W.
1860		Sutton, Francis, F.I.C., Laboratory, Bank Plain, Norwich
1886		||Sutton, Francis Napier, F.I.C., 6, Grosvenor-gardens, Cricklewood, N.W.
1902		Swain, James, 17, Winsham-grove, Clapham Common, S.W.
1875		Swan, Sir Joseph Wilson, Hon. M.A. and Hon. D.Sc., (Dun.), F.R.S., F.I.C., Overhill, Warlingham, Whyteleaf, Surrey
1894		||Swinburne, James, F.R.S., M.Inst.C.E., 82, Victoria-street, S.W.
1891		Sykes, Matthew Carrington, M.D. (Dun.), F.R.C.S. (Edin.), M.R.C.S. (Eng.), L.R.C.P. and D.P.H. (Lond.), County Maynar Tower, Hemel Hempstead
1874	Trans.	||Symons, William Henry, M.D. (Brussels), D.P.H. (Oxon.), M.R.C.S. (Eng.), F.I.C., Health Office, Guildhall, Bath
1899	Trans.	Szarvazy, Charles Emerique, Prof., Ph.D. (Buda Pesth), Műgyetem I. Ker., Budapest, Hungary
1881	Trans.	||Takamatsu, Toyokichi, Prof., Engineering College, Imperial University, Tokyo, Japan
1887	Trans.	||Takamine, Jokichi, 550, West 173rd-street, New York City, U.S.A.

Date of
Election.

1901		Tankard, Arnold Rowsby, F.I.C., 40, Lowgate, and 67, Ferens-avenue, Cottingham-road, Hull
1909		Taplin, Edward Walter, c/o Messrs E. Lacon & Co., Ltd., The Brewery, Great Yarmouth
1909		Tapp, Charles, Cradock, Cape Colony, S. Africa
1901		Tatam, George William Gerald, 19, Stainforth-road, Newbury-park, Ilford
1909		Tate, Arthur Edwin, M.Sc. (Dun.), 1, Bathurst-road, Unthank-road, Norwich
1908		Tate, Francis George Henry, 96, Barrow-road, Streatham, S.W.
1890		Tate, Francis Henry, 9, Hackins Hey, Liverpool
1881	Trans.	Tate, George, Ph.D. (Würzburg), F.I.C., Windsor Buildings, George-street, Liverpool
1884		||Tate, Walter, Tresco, Bloomfield Park, Bath
1867		Tatlock, Robert Rattray, F.I.C., Kilarden, Rosneath, Dumbar-tonshire; and 156, Bath-street, Glasgow
1905		Tayleur, John William, B.Sc. (Lond.), The Woodlands, Writtle, Chelmsford
1882		Taylor, Gotfred Midgley, Caxton House, Westminster, S.W.
1913		Taylor, Harold Victor, A.R.C.S., Thurlbere, Taunton
1894		Taylor, Herbert John, Dewsbury Technical School, Dewsbury
1880		||Taylor, James, B.Sc. (Manc.), A.R.S.M., Betys, Montague-road, Neutral Bay, N.S.W.
1891	Trans.	Taylor, John, 15, Lucius-street, Torquay
1888		Taylor, John George, 3, Outram-street, Stockton-on-Tees
1874	Trans.	||Taylor, Robert Llewellyn, F.I.C., 4, St. Werburgh's-road, Chorlton-cum-Hardy, Manchester
1901	Trans.	Taylor, William Henry, B.Sc. (Lond.), F.I.C., 36, Glenhouse-road, Eltham Park, Kent
1878		||Tcherniac, Joseph, Ph.D. (Zürich), c/o South Metropolitan Gas Co., 709, Old Kent-road, S.E.
1879	Trans.	||Teed, Frank Litherland, D.Sc. (Lond.), F.I.C., 9, Mincing-lane, E.C.
1906		Tempany, Harold Augustine, B.Sc. (Lond.), F.I.C., St. Johns, Antigua, British West Indies
1910	Trans.	Temperley, Claude Vareille, B.Sc. (Lond.), South Willingham, Lincoln
1910		Terrey, Augustus George, 47, Cann Hall-road, Leytoustone, N.E.
1894		||Terry, Edwin, 374, Brixton-road, S.W.
1893		Thackrah, James Robert, M.A. (Oxon.), Ph.D. (Leipzig), Tech-nical Schools, Tavistock-road, Plymouth
1895		Theodosius, Alfred Fletcher, M.A. (Oxon.), University College, Oxford

Date of Election.		
1912		Thévenaz, William, D.-ès-Sc. (Geneva), 48, Grey-street, Hull
1904		Thibault, Paul John, Great Cobar Street, Cobar, N.S.W.
1910	Trans.	Thole, Ferdinand Bernard, B.Sc. (Lond.), Technical College, East Ham, E.
1901		Thomas, Albert Edward, B.Sc. (Lond.), F.I.C., Boys' Middle School, Castle-street, Tiverton, Devon
1913	Trans.	Thomas, Ebenezer Rees, Emanuel College, Cambridge
1908		Thomas, Frank Moreton, 106, Fenchurch-street, E.C.
1907	Trans.	|| Thomas, Frederick, M.Sc. (Manc.), c/o Messrs. Williams Bros. and Co., Colour Manufacturers, Hounslow; and 29, Fairhaven-road, St. Anne's-on-the-Sea, Lancs.
1905		Thomas, George Devenish, B.Sc. (Lond.), 18, Randolph-gardens, Dover
1875	Trans.	|| Thomas, Joseph William, F.I.C., Overdale, 6, Kingswood-road, Shortlands, Kent
1909		Thomas, Oswald John Dalgatty, Plant No. 2, Canada Cement Co., Ltd., Longpoint, Montreal, Canada
1912		Thomas, William Leonard, 10, Victor-road, Bradford
1912		Thompson, Arthur, Parkfield Hall, Wolverhampton
1877		|| Thompson, Beeby, 67, Victoria-road, Northampton
1904		Thompson, Charles Herbert, Harrington House, Amblecote, Stourbridge
1886	Trans.	|| Thompson, Claude Metford, Prof., M.A. (Cantab.), D.Sc. (Lond.), University College, and 38, Park-place, Cardiff
1894		Thompson, Edward Cumming, Froyle House, Westcombe Park-road, S.E.
1893		|| Thompson, Frank Ernest, A.R.C.S., F.I.C., 23, Lichfield-street, Walsall
1893		Thompson, George Rudd, F.I.C., The Laboratory, 69, Dock-street, Newport, Mon.
1897		Thompson, Harry, Chemical Laboratory, 5, Bishop-lane, Hull
1913		Thompson, Percy James, The Avenue, Clytha-square, Newport, Mon.
1886		Thompson, William Phillips, Rock Edge, Upper-park, Birkenhead
1909		Thoms, Hermann, Prof., Ph.D., Hohenzollernstrasse, 6, Steglitz, Berlin, Germany
1911	Trans.	Thomson, David, M.A. and B.Sc. (Glas.), Ph.D. (Göttingen), Cotton College, Ganhati, Assam, India
1872	Trans.	|| Thomson, John Millar, Prof., Hon. LL.D. (Glas.), F.R.S., F.I.C., King's College, Strand, W.C.; and 18, Lansdowne-road, Holland Park, W.
1912		Thomson, John Scott, c/o Messrs. Thomson & Co., Crawford-street, Dunedin, New Zealand

C 1880-3,
1904-06
S. 1883-08
V.P.
1898-1901

Date of
Election.

1899		Thomson, Robert Tatlock, F.I.C., 156, Bath-street, Glasgow
1872		Thomson, William, F.I.C., Royal Institution Laboratory, Manchester
1895		Thomson, William Thomas, Broom Hall, Waltham Abbey
1882	Trans.	Thorne, Leonard Temple, Ph.D. (Würzburg), F.I.C., Highlands, Belmont, Surrey
1913		Thorne, Percy Cyril Lesley, B.A. (Cantab.), Borough Road Training College, Isleworth
1906		Thornton, Percy Charles, 44, Beechhill-road, Eltham
1906		Thorp, Arthur William, Lockford, Summerlands, Yeovil
1891		Thorp, Walter, B.Sc. (Lond. and Leeds), F.I.C., Sorrentoville, Dalkey, Co. Dublin
1871	Trans.	†||Thorpe, Sir Edward, Prof., C.B., D.Sc. (Vict.), Sc.D. (Dub.), Ph.D. (Heidelberg), LL.D. (Glas.), F.R.S., Whinfield, Salcombe, S. Devon
1893	Trans.	Thorpe, Jocelyn Field, D.Sc. (Manc.), Ph.D. (Heidelberg), F.R.S., The University, and 5, Endcliffe Hall-avenue, Sheffield
1899	Trans.	Threlfall, Richard, Prof., M.A. (Cantab.), Assoc. M.Inst.C.E., F.R.S., Oakhurst, Church-road, Edgbaston, Birmingham
1897	Trans.	||Tickle, Thomas, B.Sc. (Lond.), F.I.C., 83, Queen-street, Exeter
1902		Tidy, Henry Lethaby, M.A., M.B., and B.Ch. (Oxon.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 39, Devonshire-place, W.
1903		Tilburn, Charles, c/o The Australian Explosives and Chemical Co., Ltd., Deer Park, Victoria, Australia
1865	Trans.	||Tilden, Sir William Augustus, Emeritus Prof., D.Sc. (Lond.), Hon. Sc.D. (Dub.), Hon. D.Sc. (Vict.), Hon. LL.D. (Birm.), F.R.S., F.I.C., The Oaks, Northwood, Middlesex
1912		Till, William Compton, M.Sc. (Birm.), c/o Mount Austin Rubber Estates, Ltd., Johore, Straits Settlements
1900		Tilley, James Walter, 95a, Southwark-street, S.E.
1909		Tilley, Vernon James, F.I.C., 95a, Southwark-street, S.E.
1904	Trans.	Tingle, Alfred, B.Sc. (Aberd. and Lond.), Ph.D. (Penn.), Chemical Laboratory, Department of Customs, Ottawa, Ontario, Canada
1889	Trans.	||Tingle, John Bishop, Prof., Ph.D. (Munich), McMaster University, Toronto, Canada
1909		Tingle, Joseph Grantley, Ruthven-street, Toowoomba, Queensland
1907	Trans.	Tinkler, Charles Kenneth, D.Sc. (Birm.), B.Sc. (Wales), The University, Edgbaston, Birmingham
1898		Tisdale, Charles William Walker, The Dairy, Northallerton, Yorks.

Date of
Election.

1905	Trans.	Titherley, Arthur Walsh, D.Sc. (Vict. and L'pool.), Ph.D. (Heidelberg), Southcot, Manor-hill, Upton, near Birkenhead
1909	Trans.	Tizard, Henry Thomas, M.A. (Oxon.), Oriel College, Oxford
1907		Toch, Maximilian, 52, Ninth-street, Long Island City, N.Y., U.S.A.
1891		Tocher, James Fowler, B.Sc. (Aberd.), F.I.C., County Laboratory, Crown Mansions, 41½, Union-street, Aberdeen
1884	Trans.	||Tompson, Frederick William, The Bower, Limpsfield, Surrey
1877		||Toms, Frederick Woodland, F.I.C., Official Analyst, Jersey
1904		Tong, Walter, Sunnyside, Belgrave-road, New Moston, Failsworth, Manchester
1904		Tonkin, Arnold Bertram, Government Laboratory, Durban, Natal, S. Africa
1906		Tonkin, Ronald William, Harfenstrasse 5 II, Würzburg, Germany
1907		Tonner, William Griffiths, B.Sc. (Wales), 22, Rugby-avenue, Neath, Glam.
1893		||Towers, John William, Victoria-road, Widnes
1888		||Townsend, Charles Francis, The Orchard, Norton, Letchworth, Herts.
1903		Toyne, Francis Digby, M.A. (Cantab.), c/o Messrs. Kelsall and Kemp, Ltd., Woodhouse Mills, Norden, Rochdale
1887		||Traphagen, Frank Weiss, Prof., Ph.D. (Columbia), Colorado School of Mines, Golden, Colorado, U.S.A.
1892	Trans.	Travers, Morris William, Prof., D.Sc. (Lond.), F.R.S., Indian Institute of Science, Hebhal P.O., District Bangalore, India ; and c/o Messrs. Jeremiah Lyon and Co., 4, Lombard-court, E.C.
1906		Treble, Richard Lumley, B.Sc. (Dun.), Culham College, Culham, Oxon.
1908		Trechmann, Adolph Octavius, The Old Palace, Rochester, Kent
1895		Treharne, Frederick Gwilym, Wrangbrook, Llanishen, near Cardiff
1888		||Trewby, Herbert, Lampetts, Fyfield, Ongar, Essex
1881		||Trigger, Oliver, F.I.C., Chemical Dept., Royal Arsenal, Woolwich, S. E.
1897		Tripp, Edward Howard, Ph.D. (Marburg), The Modern School, Bedford
1909		Truelove, Charles William, B.Sc. (Lond.), 23, Woodcote-road, Wanstead, N.E.
1912		||Tsao, Hui Chun, B.Sc. (Birm.), Fudan College, Zicacwei, Shanghai, China
1910		Tschugaeff, Leo, Prof., The University, St. Petersburg, Russia
1905	Trans.	Tuck, William Bradshaw, D.Sc. (Lond.), University College, Gower-street, W.C.
1896		Tuckett, James Edwin Shum, M.A. (Cantab.), Marlborough College, Marlborough

Date of Election.		
1892		Tuer, Arthur Holt, Douglas House, Worthington, Wigan
1902		Tunncliffe, William Wright, B.Sc. (Lond.), The Herbert Strutt School, Belper
1910		Turbutt, Richard, Babington, Lieut. R.A., B.A. (Oxon.), Royal Field Artillery Mess, Fort Carlisle, Queenstown, Ireland
1897		Turnbull, Andrew, Ph.D. (Heidelberg), 18, Hackin's Hey, Liverpool
1906	Trans.	Turnbull, Robert Hutchison, F.I.C., c/o Messrs. MacAndrews and Forbes Co., 3rd-street and Jefferson-avenue, Camden, N.J., U.S.A.
1903		Turner, Arnold, 84, Molesworth-street, Rochdale
1886		Turner, Arthur, The Limes, Aylesbury
1897		Turner, Basil William, 83, Pitt-street, Sydney, N.S.W.
1913		Turner, Bertrand, B.Sc., 55, Golden Hillock-road, Small Heath, Birmingham
1888	Trans.	Turner, Charles, Ivy Villa, Nursery-lane, Wilmslow, Manchester
1906		Turner, George Augustus, 12, The Foregate, Worcester
1910		Turner, Joseph, Azo House, Birkby, Huddersfield
1883	Trans.	||Turner, Thomas, Prof., M.Sc. (Vict.), A.R.S.M., F.I.C., The University, Edgbaston, Birmingham
1903	Trans.	Turner, William Ernest Stephen, D.Sc. (Lond.), M.Sc. (Birm.), The University, Sheffield
1913		Turnill, Thomas Willoughby, c/o Atlas Preservative Co., Windmill-lane, Deptford, S.E.
1889	Trans.	Turpin, George Sherbrooke, M.A. (Cantab.), D.Sc. (Lond.), High School, Nottingham
1871		||Tustin, John Robert, Albion House, The Marina, Deal
1905	Trans.	Tutin, Frank, 278, Sandycombe-road, Kew Gardens, B.O., Surrey
1888	Trans.	Tutton, Alfred Edwin Howard, M.A. and D.Sc. (Oxon.), F.R.S., Duart, Yelverton, Devon
	C. 1909-12	
1892		Tweedie, Thomas Shortridge, Trensano, Annan
1907		Twiney, William George, B.Sc. (Lond.), 9, North-street, Kingston, Jamaica
1904	Trans.	Twiss, Douglas Frank, D.Sc. (Birm.), B.Sc. (Lond.), F.I.C., The Municipal Technical School, Suffolk-street, Birmingham
1913		Twomey, Jeremiah, M.Sc. (L'pool.), 21, Onslow-road, Elin-park, Liverpool
1899	Trans.	Tyler, Ernest Albert, M.A. (Cantab.), 33, The Promenade, Mount Pleasant, Swansea
1876		Typke, Paul George William, F.I.C., Lawn House, New Malden, Surrey
1876		Tyrer, Thomas, F.I.C., Stirling Chemical Works, Abbey-lane, Stratford, E.
1903		Tyrell, Dennis, 182, King-street, Norwich
1903		Tyson, Thomas Marshall, 109, Carpenters-road, Stratford, E.

Date of
Election.

1865		Umney, Charles, F.I.C., 50, Southwark-street, S.E.
1893	Trans.	Umney, John Charles, 50, Southwark-street, S.E.
1889		|| Underhill, Thomas John, Stanley, Quernmore-road, Bromley, Kent
1904		Underhill, William Wood, 10, Hartham-road, Holloway, N.
1897		|| Unwalla, Rustomji Navroji, Medical Dept., Bhaunagar, Kathiawâr, India
1912		Ure, Paul Jenner, c/o Messrs. Ure & Hylands, Wickham-street, Brisbane, Queensland, Australia
1909	Trans.	Usher, Francis Lawry, B.Sc. (Lond.), Central College, Bangalore, Mysore, India
1882		|| Vacher, Francis, F.R.C.S., and M.R.C.P. (Edin.), 7, Shrewsbury-road, Birkenhead
1911		Vakil, Kapibram Hardevram, B.A. (Bombay), No. 5, Santa Cruz, Bombay, India
1890		Valentin, Basil William, Messrs. Buckley Bros., Brewery, Llanelly, S. Wales
1910		Vance, John Fleming Culun Brown, 947, Richard-street, Vancouver, British Columbia
1903		Van Laer, Norbert, c/o Messrs. Truman, Hanbury, Buxton and Co., Ltd., Burton-on-Trent
1911	Trans.	Vanstone, Ernest, M.Sc. (Wales), The University, Edgbaston, Birmingham
1909		Varley, Reginald Wells, c/o Leys Malleable Castings Co., Ltd., Derby
1883		Vasey, Samuel Archibald, F.I.C., Beechcroft, Burnt Ash-lane, Bromley, Kent
1911		Vassiliev, Alexey Mikhailovich, The University, Kasan, Russia
1894		Vaux, Cuthbert, Langham Tower, Sunderland
1879	Trans.	Veley, Victor Herbert, M.A. and D.Sc. (Oxon.), F.R.S., 8, Marlborough-place, N.W.
1891		Velling, Frederick William de, B.A. (Oxon.), Municipal Secondary School, The Boulevard, Hull
1881		Venable, Francis Preston, Ph.D. (Göttingen), Chapel Hill, North Carolina, U.S.A.
1887		|| Vergara, Vargas José Maria, Apartado No. 120, Bogotá, Colombia
1911		Verschoyle, William Denham, 15, Winch-building, Vancouver, British Columbia
1901		Verteuil, Joseph de, Clarence-street, Port of Spain, Trinidad, British West Indies
1897		Vicajee, Framjee Khurshedjee, c/o Messrs. King, King & Co., P.O. Box 110, Fort, Bombay, India

Date of Election.		
1908		Vidyant, Hari Prasad, M.A. (Allahabad), C.E., Executive Engineer, Makbulganj, Lucknow, India
1911		Vipond, Harry James, B.A. (Cantab.), Dept. of Agriculture P.O. Box 434, Pretoria, S. Africa
1884		|| Voelcker, Edward William, A.R.S.M., F.I.C., Stuart House, 1, Tudor-street, New Bridge-street, E.C.
1884	{ C.1891-5, 1902-04 }	|| Voelcker, John Augustus, Hon. M.A. (Cantab.), Ph.D. (Giessen), B.A. and B.Sc. (Lond.), F.I.C., 20, Upper Phillimore-gardens, Kensington, W.
1889		|| Voss, Walter Arthur, Eastwood-road, Rayleigh, Essex
1885		Vulté, Hermann Theodore, Prof. Ph.D. (Columbia), Teachers College, Columbia University, New York City, U.S.A.
1901		|| Wade, Frank, A.R.C.S., F.I.C., 26, St. Ronan's-avenue, Southsea; and Laboratory, H.M. Dockyard, Portsmouth
1903	Trans.	Wadmore, John Mello, M.A. (Oxon.), Aldenham School, near Elstree, Herts.
1894		|| Wagner, William George, 12, North Common-road, Ealing, W.
1893		Wait, Charles Edmund, Prof., University of Tennessee, Knoxville U.S.A.
1888		|| Wait, Frank Goodell, Mines Branch, Department of Mines, Ottawa, Canada
1899		Walden, Allan Frederick, M.A. (Oxon.), New College, Oxford
1912		Waldron, Cecil Hamersley, 93, Lady Margaret-road, Tufnell Park, N.
1897		Walford, Samuel Matthew, Wyncote, Hatherlow, Stockport
1909		Waliaschko, Nikolai Awxentiewich, Prof., University Pharmaceutical Laboratory, Sumskaja 41, Charkow, Russia
1881		|| Walker, Archibald, M.A. (Oxon.), F.I.C., Newark Castle, Ayr
1898	Trans.	|| Walker, Andrew Jamieson, Ph.D. (Heidelberg), B.A. (Dub.), 57, Charnwood-street, Derby
1899		Walker, Charles, 80, Bathurst-street, Sydney, N.S.W.
1894	Trans.	Walker, Charles Henry Hirst, M.A. (Oxon.), 1, Victoria-terrace, Corkickle, Whitehaven
1889		Walker, Daniel, School of Mines, Ballarat, Victoria, Australia
1911		Walker, Eric Everard, 210, Bedford-hill, Balham, S.W.
1906		Walker, Franklin Wilfred, 42, Hatfield-road, Bedford Park, W.
1912		Walker, George, A.R.S.M., Stonehurst, Lancaster-road, Morecambe, Lancs.
1909		Walker, George Bilderbeck, 7, Foyle-road, Blackheath, S.E.
1908		Walker, Herbert, Whyttington, Station-road, Wealdstone, N.W.

Date of
Election.

1890	Trans.	{ C. 1899-04 V. P. 1909-12 }	|| Walker, James, Prof., D.Sc. (Edin.), Ph.D. (Leipzig), Hon. LL.D. (St. Andrews), F.R.S., The University, and 5, Wester-Coates-road, Edinburgh
1888			Walker, John Thom Ainslie, P.O. Box 730, G.P.O., New York City (N.W.), U.S.A.
1903			Walker-Pole, Miles, 71, De Korle-street, Braamfontein, Johannesburg, S. Africa
1905			Wall, Francis Henry, 1, Part-street, Southport
1884			|| Wallace, Robert, Prof., The University, Edinburgh
1878			|| Waller, Elwyn, A.M. (Harvard), Ph.D. (Columbia), 7, Franklin-place, Morristown, N.J., U.S.A.
1904			Walling, Léon Edward, 16, Beechhill-road, Eltham, Kent
1910			Wallis, Robert Lauder Mackenzie, B.A. (Cantab.), Pathological Dept., St. Bartholomew's Hospital, E.C.
1902			|| Wallis, Thomas Edward, B.Sc. (Lond.), F.I.C., 2, Victoria Villas, Connaught-road, Brookwood, Woking
1883			|| Walmsley, Robert Mullineux, D.Sc. (Lond.), Northampton Institute, St. John-street, Clerkenwell, E.C. ; and 23, Hildrop-road, Camden-road, N.
1905	Trans.		Walpole, George Stanley, D.Sc. (Melbourne), F.I.C., The Wellcome Physiological Research Laboratories, Brockwell Hall, Herne Hill, S.E.
1888			Walrond, Edward Dalrymple, M.A. (Cantab.), North Eastern County School, Barnard Castle, Durham
1903			Walsh, Thomas Crosbie, c/o Messrs. Rogers & Walsh, Casilla 1118, Buenos Ayres, Argentine, S. America
1899			Walton, Robert Hawks, Flinders, Martin's-avenue, Bondi, Sydney, N.S.W.
1903			Walton, Sidney Gilbert, Kensington, Northwood-road, Northwood, Lane Cove River, N.S.W.
1884			|| Walton, Thomas Utrick, B.Sc. (Glas.), F.I.C., Colonial Sugar Refining Co., Sydney, N.S.W.
1911			Walton, William Keighley, Beechwood, Upper Rushton-road, Thornbury, Bradford
1905			Want, William Phillip, 11, Pearfield-road, Forest Hill, S.E.
1864			Ward, George, F.I.C., Buckingham-terrace, Headingley, Leeds
1908			Ward, Herbert Horace, University College of Wales, Aberystwyth
1910			Ward, Percy George, B.Sc. (Lond.), A.R.C.S., The Lodge, Preston Park, Brighton
1891			|| Ward, Thomas Armistead, 15, Exchange-street, Blackburn
1907	Proc.		Warner, Charles Horne, B.Sc. (Lond.), F.I.C., The Pharmaceutical Society, 17, Bloomsbury-square, W.C.
1871			Warner, George Joseph, Halton Villa, Widnes
1906			Warren, Richard Alfred, Belle Vue, Hallow-road, Worcester

Date of Election.		
1888		Warrick, Frederic Walmsley, 6, Nile-street, City-road, N.
1895		Warrington, Thomas Cotterill, M.A. (Oxon.), 29, Stockwell-street, Leek, Staffs.
1909		Warwick, Guy Ransom, M.A. (Cantab.), c/o The Bombay British Beer Brewing Co., Ltd., The Brewery, Ferguson-road, Lower Parel, Bombay, India
1906		Wasteney, Hardolph, The Rockefeller Institute for Medical Research, 66th-street and Avenue A, New York City, U.S.A.
1882		Waterfall, Charles James, F.I.C., 4, Queen-square, Bristol
1901		|| Waterhouse, James, Major-General, I.S.C., Hurstmead, High-street, Eltham, Kent
1912		Waters, Percy Wharton, Glenberrie, Melrose-avenue, Brooklands, Sale, Manchester
1907		Watkins, Charles Rowlatt, B.A. (Cantab.), Imperial Customs Service, Custom House, Bombay, India
1908		Watkins, Edwin John, 561-563, Bourke-street, Melbourne, Australia
1885		|| Watson, Charles, Rose Bank, School-road, Moseley, Birmingham
1913		Watson, Edwin Longstaff, c/o Messrs. David Waldie & Co., Nawabganj, Cawnpore, India
1904	Trans.	Watson, Edwin Roy, Prof. M.A. (Cantab.), B.Sc. (Lond.), Dacca College, Dacca, Eastern Bengal, India
1887		|| Watson, Frederick Percy, 6 and 7, Bailgate, Lincoln
1899		Watson, Fred. Sheasby, B.Sc. (Vict.), Sandgate, Villiers-road, Woodthorpe, Nottingham
1906		Watson, Frederick William, B.Sc. (Lond.), F.I.C., Consolidated Gold Fields of South Africa, Ltd., P.O. Box 108, Germiston, Transvaal, S. Africa
1907		Watson, George Arthur, A.R.C.S.I., Clongowes Wood College, Sallins, Co. Kildare, Ireland
1911		Watson, Henry Hough, Braystones, Carnforth
1908	Trans.	Watson, Herbert Edineston, D.Sc. (Lond.), A.I.C., Indian Institute of Science, Bangalore, India
1906		Watson, John Adam, 8, Powis-gardens, Notting Hill, W.
1883		|| Watson, Thomas Donald, 16, St. Mary's-road, Bayswater, W.
1876	Trans.	|| Watson, William Henry, J.P., Braystones House, Beckermert, Cumberland
1877		Watt, Alexander, F.I.C., c/o Messrs. Macfie and Sons, 34, Moorfields, Liverpool
1904		Watt, Francis Langston, A.R.C.S., F.I.C., Russenden, Stanley-street, Epping, near Sydney, N.S.W.
1906	Trans.	Watt, Henry Edgar, D.Sc. (Dun.), F.I.C., Blandfield Chemical Works, Wheatfield-road, Edinburgh

Date of
Election

1908		Watt, John, Rev. Principal, M.A., and D.D. (Aberd.), 4, Cornwallis-Square, Calcutta, India
1908		Watt, Robert Dickie, Prof., M.A. and B.Sc. (Glas.), The University, Sydney, N.S.W.
1883	Trans.	Watts, Francis, C.M.G., D.Sc. (Birm.), F.I.C., Imperial Commissioner of Agriculture for the West Indies, Barbados, West Indies
1872	Trans.	Watts, John, M.A. (Oxon.), D.Sc. (Lond.), F.I.C., Merton College, Oxford
1878	Trans.	Watts, John Isaac, Beechfield, Hartford, Cheshire
1888		Way, Edward John, F.I.C., M.Inst.C.E., M.I.M.E., c/o Anglo, French Exploration Co., P.O. Box 2927, Johannesburg, S. Africa
1911		Waygood, Bertie James, 39, Marshall-road, Levenshulme, Manchester
1901		Wayland, William Abraham, 12, Albert-road, St. John's, S.E.
1913		Webb, Edward, B.Sc. (Lond.), Berwyn, Totteridge, Whetstone, N.
1883	Trans.	Webster, Charles Stuart Stanford, F.I.C., 25, Cotham-road, Bristol
1909		Webster, John, F.I.C., Laboratory of Pathological Chemistry, St. Mary's Hospital, Paddington, W.
1907		Wechsler, Marcus, D.Sc. (Grenoble), 136, Sinclair-road, Kensington, W.
1904		Weeks, Henry Bridges, F.I.C., The Retreat, Infield-park, Barrow-in-Furness
1908		Weighell, Arthur, Laboratory and Assay Office, Prince-building, Meadows-street, Fort, Bombay, India
1905		Weiskopf, Eric Hartwig, Ph.D. (Toulouse), c/o Authors' Club, Whitehall court, W.
1903		Weiss, Carl Friederich Richard, M.A. and Ph.D., (Bâle), 23, Cloth Fair, E.C.
1898		Weissmüller, Edward Charles, Hill Crest, The Heath, Runcorn
1909	Trans.	Weizmann, Charles, D.Sc. (Manc.), Ph.D. (Freiburg), 57, Birchfields-road, Rusholme, Manchester
1893		Welchman, Frank Ernest, 16, Carlton-road, Putney Hill, S.W.
1891		Wellington, Stephen Newcombe, Assoc.M.I.E.E., 53, Victoria-street, Westminster, S.W.
1884	Trans.	Wells, James Simpson Chester, Ph.D. (Columbia), Cañon City, Col., U.S.A.
1890		Wells, Sydney Russell, M.D. and B.Sc. (Lond.), M.R.C.S. (Eng.), M.R.C.P. (Lond.), 16, Lower Seymour-street, Portman-square, W.
1903		Welsford, Giles Haddon, The Briars, Bury Green-road, Cheshunt, Waltham Cross

Date of Election.		
1897	Trans.	Welsh, John, M.R.C.S. (Eng.), L.R.C.P. (Lond.), 43, Tarvin-road, Chester
1888		Werner, Emil Alphonse, Prof., F.I.C., 1, Fairfield-park, High-field-road, Rathgar, Dublin
1886		|| Wertheimer, Julius, Prof., D.Sc. (Bristol), B.A. and B.Sc. (Lond.), F.I.C., Merchant Venturers' Technical College, Bristol
1902		West, Joseph, Beechwood, The Avenue, Kidsgrove, Stoke-on-Trent
1909		West, Percy Charles Henry, 153, Barnsbury-road, Barnsbury, N.
1898	Proc.	Weston, Frank Edwin, D.Sc. (Lond.), 29, Sibella-road, Clapham, S.W.
1892		Whalley, Lawrence John de, B.Sc. (Lond.), F.I.C., 18, Brandram-road, Lee, S.E.
1893		Whalley, Sidney, B.Sc. (Lond.), 18, Nevilledale-terrace, Durham
1908		Wheatley, William, M.A. (Oxon.), 4, Rock-mount, Adelaide-terrace, Blackburn
1906		Wheaton, Harold Joseph, A.C.G.I., Spondon, Derby
1907	Trans.	Wheeler, Edward, A.C.G.I., c/o Messrs. S. Courtauld & Co., Ltd., Foleshill-road, Coventry
1902		Wheeler, Edward Jonathan, Ph.D., 79, Chapel-street, Albany, N.Y., U.S.A.
1894		Wheeler, Henry Lord, Ph.D. (Yale), The Sheffield Laboratory, New Haven, Conn., U.S.A.
1909		Wheeler, Richard Vernon, D.Sc. (Manc.), Home Office Experimental Station, Eskmeals, Cumberland
1893		|| Wheeler, William Ernest, 33, Haverstock-road, Knowle, Bristol
1897		Wheelwright, Edwin Whitfield, B.A. (Oxon.), Ph.D. (Munich), F.I.C., Greenholme, 24, Stanmore-road, Edgbaston, Birmingham
1911		Wheldon, Alfred Henry Finnis-, Mount Edgecombe Estate, Mount Edgecombe P.O., Natal, S. Africa
1897		While, Arthur James, Glen Garth, Barrow-in-Furness
1902		White, Carter, A.I.Mech.E., 9 & 11, High-street, Battersea, S.W.
1891		White, Henry, Eastville, Norwood-road, Sheffield
1893		White, Henry Clay, Prof., Ph.D. (Virginia), Hon. D.C.L. (Univ. South), Hon. LL.D. (Illinois), University, Athens, Georgia, U.S.A.
1899		White, Henry Fox, 52, Royal York-crescent, Clifton, Bristol
1905		White, John Ledger, D.Sc. (Dun.), 93, Stormont-road, Clapham Common, S.W.; and Battersea Polytechnic, Battersea Park-road, S.W.
1905		White, John William, B.Sc. (Lond.), c/o The E.C. Powder Co., Green Street Green, Dartford
1897		White, Paul Thomas, Hortonfield House, West Drayton, Middlesex

Date of
Election.

1893		|| White, William Gilchrist, Vicarage View, 133, Tottington-road, Bury, Lanes.
1885		Whitehead, Henry Hammond, 18, Boston-road, Brentford
1896		Whitehead, James, 8, West-street, Rochdale
1901		|| Whitehouse, Philip Lewington, 16, Lombard-street, West Bromwich
1904	Trans.	Whiteley, Charles Edward, 21, Brudenell-view, Leeds
1886	Proc.	|| Whiteley, Richard Lloyd, F.I.C., Municipal Science and Technical School, West Bromwich
1892		Whiteside, John Lowe, 376, St. Helen's-road, Bolton
1863		|| Whitfield, John, 113, Westborough, Scarborough
1899		Whittaker, Christopher Joseph, c/o United Indigo and Chemical Co., Ltd., 1, Cooper-street, Manchester
1889		Whittam, Matthew, M.A. (Cantab.), 75, Creffield-road, West Acton, W.
1901		Whittle, James, 30, Bridge-street, Morpeth
1907		Whymper, Robert, A.C.G.I., St. Clare, St. Mary's-road, Ditton Hill, Surrey
1906		Wiffen, Henry John, 17, Albany-road, Manor-park, E.
1889		Wigan, Basil Penwarne, Rhondda Valley Brewery Co., Treherbert, Pontypridd
1905		Wigginton, John Henry Becker, 2, Kitson-road, Barnes, S. W.
1906		Wightman, Charles, Springfield, Stevenage
1896	Proc.	Wigner, John Harrison, Ph.D. (Heidelberg), c/o Messrs. W. Gossage & Sons, Ltd., Soap Works, Widnes
1896		Wilcox, Alfred James, Rev., The Vicarage, Maiden Bradley, Bath
1891		|| Wild, John, B.Sc. (Vict.), A.I.C., Bredbury House, Bredbury, Stockport
1909		Wild, Thomas Jabez, c/o Messrs. Burroughs Wellcome & Co., 35-39, West 33rd-street, New York City, U.S.A.
1898		|| Wild, William Ernest, B.Sc. (Vict.), 105, Shaw-lane, Dinting, near Glossop
1898		Wilder, Frederick Louis, 10, Forest-rise, Walthamstow, N.E.
1897	Trans.	Wilderman, Meyer, Ph.D. (Freiburg), B.Sc. (Oxon.), 10, Elers-road, Ealing, W.
1912		Wilkins, Charles Reginald, B.Sc. (Lond.), 8, Crookston-road, Eltham-park, Eltham
1904		Wilkinson, James Alfred, M.A. (Cantab.), South African School of Mines and Technology, P.O. Box 1176, Johannesburg, S. Africa
1903		Wilkinson, James Bates, M.D. and C.M. (Edin.), D.P.H. (Vict.), Town Hall, Oldham
1893		Wilkinson, John, City Gas Offices, 6, George-street, Nottingham

Date of Election.		
1905		Wilkinson, John Wells, M.A. (Wales and Bristol), Longhope, Essendenc-road, Belvelere, Kent
1891		Will, Wilhelm, Prof., Ph.D. (Berlin), Dunckerstrasse 4, Grunewald, Berlin, Germany
1904	Proc.	Willcox, William Henry, M.D., B.Sc., M.R.C.P. and L.S.A. (Lond.), D.P.H. (Eng.), F.I.C., St. Mary's Hospital, Paddington, W.
1906		Willetts, Herbert William Mills, 3, Brasenose House, Kensington High-street, W.
1905		Williams, Alan Herbert, Brockweir, Urmston, Manchester
1913		Williams, Cornelius, B.Sc. (Lond.), A.R.C.S., Central Experiment Farm, Cedara, Natal, S. Africa
1903		Williams, David John, Bath and West of England College of Chemistry and Pharmacy, 6, Cleveland-place, East Bath
1908		Williams, David Thomas, 42, Finsbury-square, E.C.
1895		Williams, Evan, Bradford-road Gas Works, Manchester
1908		Williams, Frederick, M.A. (Oxon.), Bute Villa, Aberdare, S. Wales
1910		Williams, Frederick George, The Gun and Shell Factory, Cossipore, Calcutta, India
1912		Williams, George Mason, 47, Lamb's Conduit-street, W.C.
1909	Proc.	Williams, Herbert Ernest, 73, Mackenzie-road, Beckenham
1910	Proc.	Williams, Herbert Goulding, B.Sc. (Lond.), Robert Gordon's College, Aberdeen
1892		Williams, John, Government Laboratory, British Guiana
1910		Williams, John, B.Sc. (Lond. and N. Z.), 122, Liddell-street, Invercargill, New Zealand
1908		Williams, Joseph Henry, 49, Addison-road, Snaresbrook, N.E.
1907	Proc.	Williams, Percy, B.Sc. (Lond.), 19, Tankerville-road, Greyhound-lane, Streatham Common, S.W.
1883	Proc.	Williams, Rowland, F.I.C., 79, Queen-square, Lancaster
1891		Williams, Seward Whiting, c/o Messrs. Bauer and Black, 25th and Deaborn-streets, Chicago, Ill., U.S.A.
1872	Trans.	|| Williams, Thomas, 15, Heywood-road, Broad-green, Liverpool
1885	Trans.	|| Williams, Walter Collingwood, B.Sc. (Lond.), F.I.C., Public Analysts Laboratory, 36, Dansie-street, Liverpool
1899	Proc.	Williams, William Arthur, 19, Craylockhart-terrace, Edinburgh
1874	Trans.	|| Williams, William Carleton, B.Sc. (Vict.), F.I.C., Broomgrove, Goring-on-Thames, Reading
1898		Williamson, John Alexander, The Croft, Chase Court-gardens, Enfield, Middlesex
1874	Trans.	|| Williamson, Robert, F.I.C., Messrs. Williamson and Corder, Ltd., Walker, Newcastle-on-Tyne

Date of
Election.

1886	Trans.	Williamson, Sidney, Ph.D. (Munich), F.I.C., c/o The Cooper Research Laboratory, Berkhamsted, Herts.
1898		Williamson, William, 94, Hainault-road, Leytonstone, N.E.
1907		Willott, David, B.Sc. (Lond.), Nutcombe, Cumnor-road, Sutton, Surrey
1896		|| Wills, Sir Edward Chaning, Bart., M.A. (Cantab.), Harcombe, Chudleigh, Devon
1909		Wills, Harry Sampson, 55, Arngask-road, Catford, S.E.
1872		Wills, Joseph Lainson, c/o Otto F. Stifel's Union Brewing Co., Gravois and Michigan-avenues, St. Louis, Mo., U.S.A.
1892	Trans.	Wilsmore, Norman Thomas Mortimer, Prof., D.Sc. (Melbourne), The University, Perth, Western Australia
1885		Wilson, Alfred Charles, F.R.S.E., 118, High-street, Stockton-on-Tees
1879		|| Wilson, Charles Joseph, F.I.C., 14, Suffolk-street, Pall Mall-east, S.W.
1894		Wilson, Christopher, The Grammar School, Manchester
1883	Trans.	|| Wilson, David, M.A. and D.Sc. (Glas.), Carbeth, Killearn, Glasgow
1901		|| Wilson, Duncan Randolph, 44, Whitehall-court, S.W.
1913		Wilson, Ernest John, M.A. (Cantab.), F.I.C., Osborne House, Wisbech
1912	Trans.	Wilson, Forsyth James, D.Sc. (Lond.), Ph.D. (Leipzig), Royal Technical College, Glasgow
1899	Proc.	Wilson, Frederick Robert Leyland, M.A. (Oxon.), Charterhouse, Godalming
1908		Wilson, Harry Percy, 223, Maldon-road, Colchester
1875		|| Wilson, James, M.A. (Dub.), Barrister-at-Law, 2, Essex-court, Temple, E.C. ; and 121, Claremont-road, Forest Gate, Essex
1890		Wilson, James Mitchell, M.D. and C.M. (Glas.), D.P.H. (Cantab.), County Hall, Beverley
1895	Proc.	Wilson, John, M.Sc. (Vict.), F.I.C., Battersea Polytechnic, S.W.
1902		Wilson, Lyndon Charles, 5, Wellington-road, Newark-on-Trent
1900	Proc.	Wilson, Leonard Philip, F.C.G.I., 8, Chester-street, Coventry
1909	Trans.	Wilson, Robert William, 120, Wanstead-park-avenue, Wanstead, N.E.
1913		Wilson, Siddons Siddons, 154, Burges-road, East Ham, E.
1871		|| Wilson, William John, c/o Dr. W. M. Watts, Shirley, Venner-road, Sydenham, S.E.
1907		Wilson, William John, A.C.G.I., 12, Vicarage-park, Plumstead, Kent
1884		Wilton, Thomas, The Gas Light and Coke Co., Beckton, North Woolwich, S.E.
1893		Winder, Edward Humphreys, Felton, Ludlow

Date of Election.		
1894		Wingate, Hamilton More, B.Sc. (Glas. and Melbourne), 30, Temple-grove, Golder's Green, N.W.
1895		Wingfield, Thomas Rowland, 12, Suffolk-road, Bournemouth, West
1911		Wink, Ian Gordon Sellars, 10, Richmond-road, West Wimbledon, S.W.
1876		Winser, Percy James, F.I.C., Heath House, Knutsford
1913		Winstanley, Thomas Harrison, 45, Dicconson-street-west, Wigan
1906		Winther, Christian, Ph.D. (Copenhagen), Ostervold 5, Copenhagen, Denmark
1911		Wishart, George, M.A. (Oxon.), H.M.S. Conway, Liverpool
1898	Trans.	Witham, Ernest, B.A. and B.Sc. (Lond.), The Grammar School, Rotherham
1912	Trans.	Withers, John Charles, Ph.D. (Würzburg), 83, Edgeley-road, Clapham, S.W.
1908		Withey, William Henry, B.A. (Cantab.), 47, Clarence-road, Teddington
1876	Trans.	Witt, Otto Nikolaus, Geh. Rat Prof., Dr., Ebereschentallee 10, Westend bei Berlin, Germany
1906		Wolfe, Ernest Edwin, Kinsale, Co. Cork, Ireland
1910		Wolfenden, Stuart Jardine Norris, The Conservative Club, St. James'-street, S.W.
1907		Wolff, Mark Arthur, 618, Pacific-building, Vancouver, British Columbia
1902		Womersley, Charles Edward, 151, High-street, Heckmondwike, Yorks.
1889		Wood, Charles, Rossemount, Emm-lane, Heaton, Bradford
1860	Trans.	Wood, Charles Henry, F.I.C., Erica, Bournemouth-road, Parkstone, Dorset
1911		Wood, Edward Escott, Hurricane House, Brymbo, Wrexham
1908		Wood, Francis Charles Benjamin, Deurne, near Antwerp, Belgium
1902		Wood, Frank Stanley, 12, Carlton-avenue, Hornsea, Hull
1913		Wood, Hubert Rogers, c/o Messrs. Fenner and Alder and Co. Ltd., Millwall, E.
1912	Trans.	Wood, John Kerfoot, D.Sc. (Vict.), 304, Blackness-road, Dundee
1898	Trans.	Wood, Thomas Barlow, Prof., M.A. (Cantab.), School of Agriculture, Cambridge
1911		Wood, William, Tyneholme, Dudley-street, Roseville, N.S.W., Australia
1903		Wood, William Francis John, B.Sc. (Lond.), Ardsley House, near Barnsley
1900		Woodbridge, Walter Bourne, A.C.G.I., c/o A. E. Woodbridge, Esq., The Steyne, Bognor

Date of
Election.

1871	Trans.	Woodcock, Reginald C., F.I.C., The Sanitas Co., Ltd., Locksley-street, Limehouse, E.
1904		Woodcock, William Henry, Craigfernie, Felbrigge-road, Goodmayes, Essex
1898		Woodhead, Samuel Allinson, B.Sc. (Dun.), F.I.C., Agricultural College, Uckfield, Sussex
1909		Woods, George James, B.Sc. (Lond.), Rutlish School, Merton, S.W.
1892		|| Woods, Hugh, B.A., M.D. and B.Ch. (Dub.), D.P.H., (R.C.P.S.I.), Red House, Borden, Tonbridge
1888		Woodward, James, B.A. and B.Sc. (Lond.), F.I.C., Drummond House, 31, Coventry-road, Ilford, Essex
1889		Woolf, Mortimer, Mayfield, Mortimer-road, N.W.
1903		Woolhouse, Sidney Herbert, M.A. and B.Sc. (Dub.), A.R.C.S.I., Eastleigh, Latymer-road, Lower Edmonton, N.
1889		Woosnam, Richard William, F.I.C., Caprons, Hutton, Brentwood
1908	Trans.	Wootton, Hubert Arthur, M.A. (Cantab.), B.Sc. (Lond.), 20, Great College-street, Westminster, S.W.
1903		Worden, Edward Chancey, M.A. (N.Y.), Clark Thread Co., Newark, N.J., U.S.A.
1908	Trans.	Worley, Frederick Palliser, D.Sc. (Lond.), M.A. and M.Sc. (N.Z.), D.I.C., Ferrybridge House, Clifton-gardens, Maida Hill, W.
1884		|| Worrall, Jason Hall, F.I.C., Howsley, Chapel-town, near Sheffield
1858		|| Worsley, Philip John, Rodney Lodge, Clifton, Bristol
1906		Wortley, Edward Jocelyn, Rectory, Half-way-tree, Jamaica
1906	Trans.	Wren, Henry, M.A. (Oxon.), D.Sc. (Lond.), Ph.D. (Tübingen), Municipal Technical Institute, Belfast
1905		Wren, William James, A.R.C.S., Hiltor College, near Maritzburg, Natal, S. Africa
1898		Wrench, Charles Arthur, 95A, Southwark-street, S.E.
1908		Wright, Allister MacLean, P.O. Box 617, Christchurch, New Zealand
1908		Wright, Charles Harold, B.A. (Cantab.), F.I.C., Government Laboratory, Port of Spain, Trinidad, British West Indies
1911		Wright, Ernest Walter, 179, Edgware-road, W.
1895		Wright, Harold Edward, c/o Sir B. Samuelson and Co., Ltd., Middlesbrough
1909		Wright, Joseph Pretty, 883, Burrard-street, Vancouver, B. Columbia
1878		|| Wright, Lewis Thompson, Junior Constitutional Club, Piccadilly, W.; and The Rio Tinto Assay Office, Marsh Gate-lane, Stratford, E.
1894		Wright, Robert, 5, Devonshire-colonnade, Buxton
1911	Trans.	Wright, Robert, M.A. (R.U.I.), Lauriston, Derrysolgie-avenue, Belfast

Date of Election.		
1910		Wright, William Norman Stewart, 26, Lansdowne-crescent, Glasgow, W.
1886	Trans.	|| Wright, William Thomas, 11, Rundle-road, Sheffield
1864		|| Wrightson, John, Prof., 13, Charleville-mansions, West Kensington, W.
1906		Wyatt-Edgell, Cecil, M.A. (Oxon.), 87, Merridale-road, Wolverhampton
1880		Wyborn, John Middleton, Shoulden, Farnaby-road, Bromley, Kent
1884		|| Wyley, William Fitzthomas, Wheatley-street, Coventry
1885	Trans.	(C. 1892-6. S. 1893-00, 1903-05 V.-P 1905-08.) || Wynne, William Palmer, Prof., D.Sc. (Lond.), F.R.S., F.I.C., A.R.C.S., The University, and 17, Taptown-village, Sheffield
1913		Wyver, Clifton, 37, Boulton-street, Wolstanton, Stoke-on-Trent
1911		Yates, Charles Fursdon, Ronaldene, Witham-road, Isleworth
1908		|| Yates, Harry James, M.I.M.E., Redcroft, Four Oaks, Warwickshire
1908	Trans.	Yates, Joseph, M.Sc. (Manc.), B.Sc. (Lond.), F.I.C., Municipal Technical School, Blackburn
1886	Trans.	Yoshida, Hikokurō, Prof., Imperial University of Kyoto, Kyoto, Japan
1885		Young, Alfred Collett, 17, Vicar's-hill, Lewisham, S.E.
1903		Young, Andrew, M.A. and B.Sc. (Edin.), Geological Department, South African College, and 5, Rosmead-avenue, Cape Town, S. Africa
1886		|| Young, Brougham, Clarence House, 4 and 8, Arthur-street-west, E.C.
1908	Trans.	Young, Charles Robert, B.Sc. (Lond.), The University, Sheffield
1897		Young, Francis Samuel, M.A. (Oxon.), F.I.C., The College, Bishop's Stortford
1877		|| Young, Frank Watson, F.R.S.E., 32, Buckingham-terrace, Botanic-gardens, Glasgow
1890	Trans.	|| Young, George, Ph.D. (Erlangen), F.I.C., Bradla, Church-crescent, Church-end, Finchley, N.
1895		Young, Henry Stow, F.I.C., c/o The Borneo Co., Ltd., Kuching, Sarawak
1894		Young, James, 12, Edge-hill, Plumstead, Kent
1874		Young, John, 164, Bath-street, Glasgow
1910		Young, John, A.I.C., A.R.T.C. (Glas.), P.O. Box 164, Akron, Ohio, U.S.A.

Date of
Election.

1898			Young, John Henry, M.Sc. (Vict.), c/o Cassel Cyanide Co., Ltd. Shuna-street, Maryhill, Glasgow
1877			|| Young, John Rymer, The Lindens, Grappenhall, Warrington
1909			Young, Roland Francis, c/o Tarkwa Trading Co., Tarkwa, Gold Coast, W. Africa
1882	Trans.	C 1894-8.	|| Young, Sydney, Prof., D.Sc. (Lond.), B.Sc. (Manc.), Hon. Sc.D. (Dub. and Bristol), F.R.S., F.I.C., Trinity College, Dublin
1913	.		Young, Thomas Howard, 118, Scotia-street, Winnipeg, Man. Canada
1873			|| Young, William Charles, F.I.C., 2, Queen Anne's-grove, Bedford Park, W. ; and Chemical Laboratory, 24, Aldgate, E.
1913	Trans.		Young, William John, D.Sc. (Lond.), M.Sc. (Manc.), Australian Institute of Tropical Medicine, Townsville, N. Queensland, Australia
1910			Yusuf, Syed Muhammad, M.Sc. Tech. (Manc.), c/o Syed Ghulam Imám, Chilkáná, District Saharanpur, U.P., India
1907	Trans.		Zortman, Israel Hyman, B.Sc. (Vict.), Ph.D. (Leipzig), c/o Messrs. Roseuberg & Co., 259, High Holborn, W.C.

NUMBER OF HONORARY AND FOREIGN MEMBERS ... 35

.. .. FELLOWS 3190

